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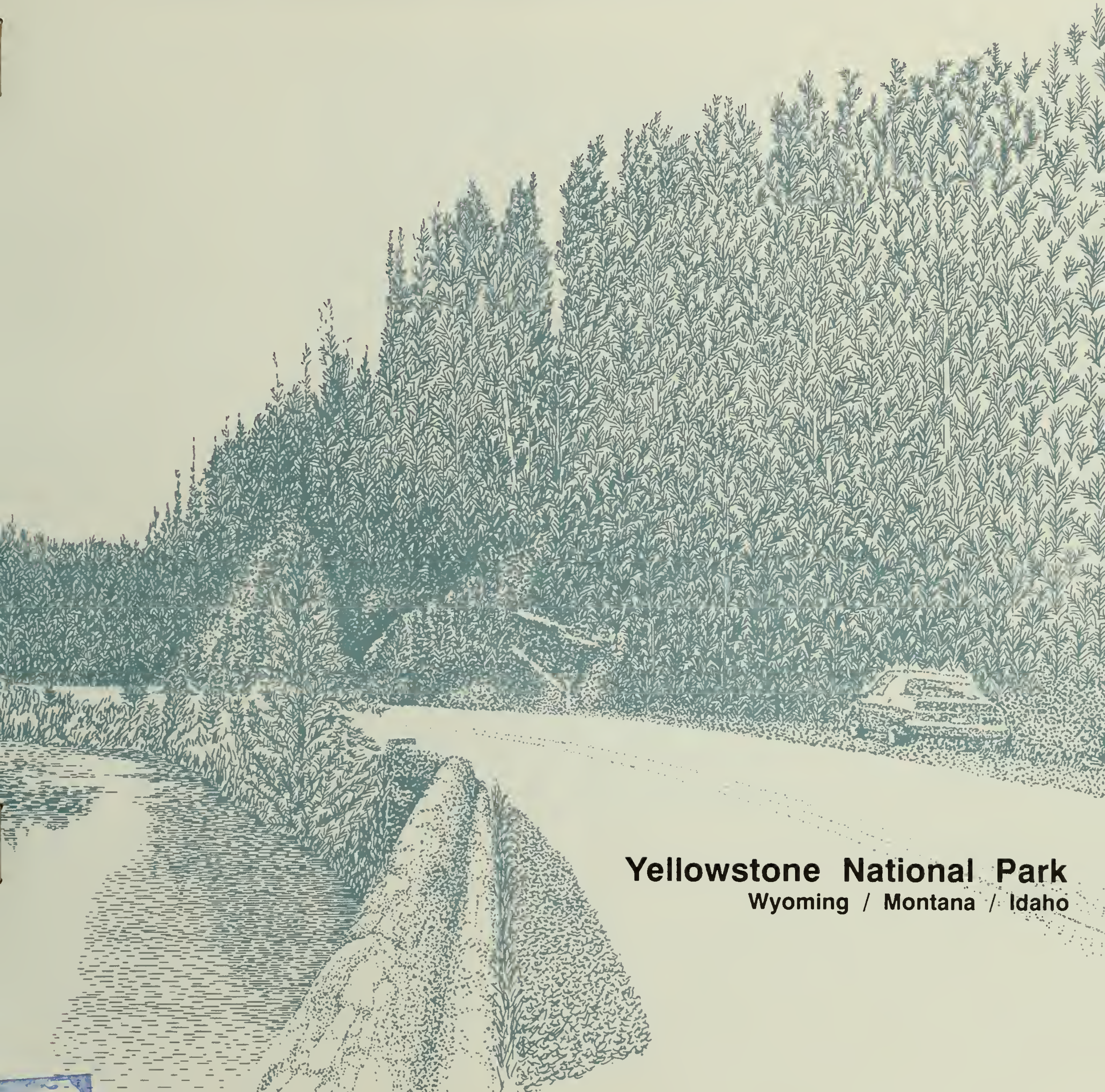
Parkwide Road Improvement Plan Environmental Assessment



Yellowstone National Park

Wyoming / Montana / Idaho

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parkwide road improvement plan environmental assessment

draft
february 1992

Typical Poor Road Condition

Typical Reconstructed Road

Yellowstone National Park • Wyoming / Montana / Idaho

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SUMMARY

The National Park Service (NPS) has prepared a draft plan for road improvement and material source needs for Yellowstone National Park. The intent of the proposed parkwide road improvement plan is to preserve and extend the service life of principal park roads and to enhance their safety. This document describes and analyzes the potential environmental effects of the proposed plan and several alternatives. Separate route- and design-specific environmental documents will be prepared as needed for each road improvement project.

This document was prepared in compliance with the requirements of the National Environmental Policy Act, section 7 of the Endangered Species Act, and the National Historic Preservation Act. Consultation with the U.S. Fish and Wildlife Service will be conducted concurrently with public review of the *Parkwide Road Improvement Plan/Environmental Assessment*. Consultation is underway with the historic preservation offices for the states of Wyoming, Montana, and Idaho.

The proposed plan calls for a long-term program of road improvement consisting of a combination of major reconstruction (MR) projects and resurfacing, restoration, and rehabilitation (3R) projects, which would provide a temporary solution for roads that may ultimately be reconstructed. Additionally, the need for material sources to supply the proposed road improvement projects is discussed. Existing sources in the park as well as sources outside the park have been identified in the Federal Highway Administration (FHWA) preliminary draft material source study. Because of the large amount of road improvement work that would occur in the park, the Park Service must find acceptable and economical sources of quality material.

Alternative A would continue existing road maintenance in the park. Alternative B would entail a program of 3R road projects only, while alternative C considers only MR projects. Under alternative AA, material would continue to be purchased from existing commercial sources, while alternative BB considers using material sites outside the park exclusively. Considered but rejected were the options to use only material sites located within the park, to develop new material sites within the park, and to do only pavement overlay work.

No significant adverse effects on natural resources would be likely under the proposed plan or any of the alternatives. There could be adverse effects on cultural resources under the proposed plan or alternatives. Any adverse effects would be appropriately mitigated. The proposed plan would include a combination of road improvement types and material from both within and outside park boundaries. The proposed plan would vary and disperse road improvement activities in the park, minimize resource impacts, and enable reclamation of existing material sites in the park.

Please address comments to:

Superintendent
Parkwide Road Improvement Plan
P.O. Box 16
Yellowstone National Park, WY 82190

CONTENTS

INTRODUCTION 1

PURPOSE OF AND NEED FOR THE PLAN 7
- NEED FOR ROAD IMPROVEMENT 7
- NEED FOR ROAD MATERIAL SOURCES 8
- PURPOSE OF THE PLAN/EA 9
  - Road Improvement 10
  - Road Material Sources 10
- NATIONAL PARK SERVICE POLICY AND OTHER PLANNING CONSIDERATIONS 13
- OTHER PUBLIC SECTOR CONSTRUCTION PROGRAMS IN THE GYA 14
- OTHER CONSTRUCTION/MAINTENANCE PROJECTS IN YELLOWSTONE 15

AFFECTED ENVIRONMENT 17
- REGIONAL OVERVIEW 17
  - Greater Yellowstone Area (GYA) 17
  - Yellowstone National Park 17
- NATURAL RESOURCES 19
  - Geology and Thermal Areas 19
  - Topography and Soils 19
  - Vegetation 20
  - Wildlife 21
  - Threatened and Endangered Species 23
  - Water Resources and Quality 29
  - Floodplains and Wetlands 30
  - Air Quality 31
- CULTURAL RESOURCES 32
  - Archeological Resources 32
  - Historic Resources 32
- SOCIOECONOMIC ENVIRONMENT 34

PROPOSED PARKWIDE ROAD IMPROVEMENT PLAN 37
- COMBINED PROGRAM OF 3R AND MR PROJECTS 37
- MITIGATING MEASURES 38
  - Road Design/Construction 38
  - Natural Resources 41
  - Cultural Resources 41
  - Socioeconomic Environment 43
- ROAD MATERIAL SOURCES 44

- MITIGATING MEASURES 49
  - Natural Resources 49
  - Cultural Resources 49
  - Socioeconomic Environment 49

- ALTERNATIVES TO THE PROPOSED PLAN FOR ROAD IMPROVEMENT 51
  - ALTERNATIVE A: NO ACTION 51
  - ALTERNATIVE B: 3R ONLY 51
    - Mitigating Measures 51
      - Natural Resources 51
      - Cultural Resources 51
      - Socioeconomic Environment 52
  - ALTERNATIVE C: MR ONLY 52
    - Mitigating Measures 52
      - Natural Resources 52
      - Cultural Resources 52
      - Socioeconomic Environment 52

- ALTERNATIVES TO THE PROPOSED PLAN FOR ROAD MATERIAL SOURCES 53
  - ALTERNATIVE AA: NO ACTION 53
  - ALTERNATIVE BB: SOURCES FROM OUTSIDE OF THE PARK ONLY 53

- ALTERNATIVES CONSIDERED BUT REJECTED 53
  - PAVEMENT OVERLAY ONLY 53
  - SOURCES FROM INSIDE THE PARK ONLY 53
  - DEVELOPMENT OF NEW MATERIAL SITES WITHIN THE PARK 54

- SUMMARY OF ROAD IMPROVEMENT MATERIAL NEEDS AND COSTS 55

- ENVIRONMENTAL CONSEQUENCES 57
  - PROPOSED PLAN 57
    - Impacts of Road Improvement, Combined 3R and MR Projects 57
      - Natural Resources 57
      - Cultural Resources 59
      - Socioeconomic Environment 59
      - Cumulative Effects 61
    - Impacts of Road Material Sources, In-park and Out-of-park Sources 64
      - Natural Resources 64
      - Cultural Resources 65
      - Socioeconomic Environment 65
      - Cumulative Effects 66

ROAD IMPROVEMENT ALTERNATIVES 62
  Impacts of Alternative A: No Action 67
    Natural Resources 67
    Cultural Resources 67
    Socioeconomic Environment 67
  Impacts of Alternative B: 3R Only 69
    Natural Resources 69
    Cultural Resources 69
    Socioeconomic Environment 70
  Impacts of Alternative C: MR Only 70
    Natural Resources 70
    Cultural Resources 70
    Socioeconomic Environment 71
ROAD MATERIAL SOURCE ALTERNATIVES 71
  Impacts of Alternative AA: No Action 71
    Natural Resources 71
    Cultural Resources 72
    Socioeconomic Environment 72
  Impacts of Alternative BB: Out-of-Park Sources Only 72
    Natural Resources 72
    Cultural Resources 73
    Socioeconomic Environment 73

FUTURE COMPLIANCE REQUIREMENTS 75
  SECTION 106, NATIONAL HISTORIC PRESERVATION ACT 75
  SECTION 404, CLEAN WATER ACT 75
  EXECUTIVE ORDERS 11988 AND 11990 75
  STORM WATER RULE 76
  SECTION 7- ENDANGERED SPECIES ACT 76

AGENCIES/ORGANIZATIONS CONTACTED 77

APPENDIX A 79

APPENDIX B 103

APPENDIX C 115

REFERENCES 119

PREPARERS AND CONSULTANTS 123

MAPS

Rocky Mountain Region Map 3
Greater Yellowstone Area Map 5
Road Improvement Study Area Map 11
Grizzly Bear Recovery Zone Map 25
Proposed Road Improvement Program Map 39
Road Material Need Areas Map 45
Recommended Material Sources and Other Uses 81

TABLES

Table 1: Estimated Material Quantities for Road Improvement in Yellowstone 56

INTRODUCTION

Yellowstone National Park is located mainly in the northwestern corner of Wyoming with portions that extend into southwestern Montana and southeastern Idaho (see Region map). The park lies within Wyoming's Teton and Park counties, Montana's Park and Gallatin counties, and Idaho's Fremont County. Yellowstone encompasses 2,221,722 acres (3,472 square miles), with an existing active and improved road system of approximately 329 miles. Yellowstone, parts of six national forests, and Grand Teton National Park, including the John D. Rockefeller, Jr. Memorial Parkway, comprise the Greater Yellowstone Area (GYA) (see Greater Yellowstone Area map).

In 1915 the first entrance permit was issued for an automobile, and Yellowstone was forever changed. Horses and stagecoaches rapidly became things of the past, and roads built for horses and wagons were tortuous for automobiles. Motors overheated and brakes burned out on steep grades; vehicles sank over their hubs in mud after rainstorms. Nonetheless, travel by auto was faster and cheaper than by stagecoach. Automobiles made Yellowstone accessible to a much broader segment of the public, and the development of safe roads became important.

The Grand Loop Road, which grew out of the need to provide visitor access, traces a figure-eight pattern through the center of the park, and together with the five entrance roads, forms the principal park road system. It provides the only means of motor vehicle access to the geologic and scenic wonders of Yellowstone. Major access roads enter the park from the north, northeast, east, south, and west, and feed into the large central loop road system, which connects the park's major visitor attractions. Many of the highways in the tri-state region lead to Yellowstone, and the principal park roads form the hub of the region's limited highway network. Numerous collector roads provide access to facilities such as parking areas, picnic sites, employee residences, and administrative and maintenance facilities.

Park roads are intended to enhance visitor experiences while providing for the safe and efficient accommodation of park visitors (*National Park Service Park Road Standards* 1984). The National Surface Transportation Assistance Act of 1982, PL 97-424, established a coordinated federal lands highway program (FLHP) for the construction and rehabilitation of federal agency roads, including park roads. The Park Service has the responsibility to construct, operate, and maintain its roads in a safe and aesthetically pleasing condition to the greatest extent possible. Consistent with this mandate, a long-term program has been initiated to address the surface transportation system needs within its jurisdiction (NPS 1986).

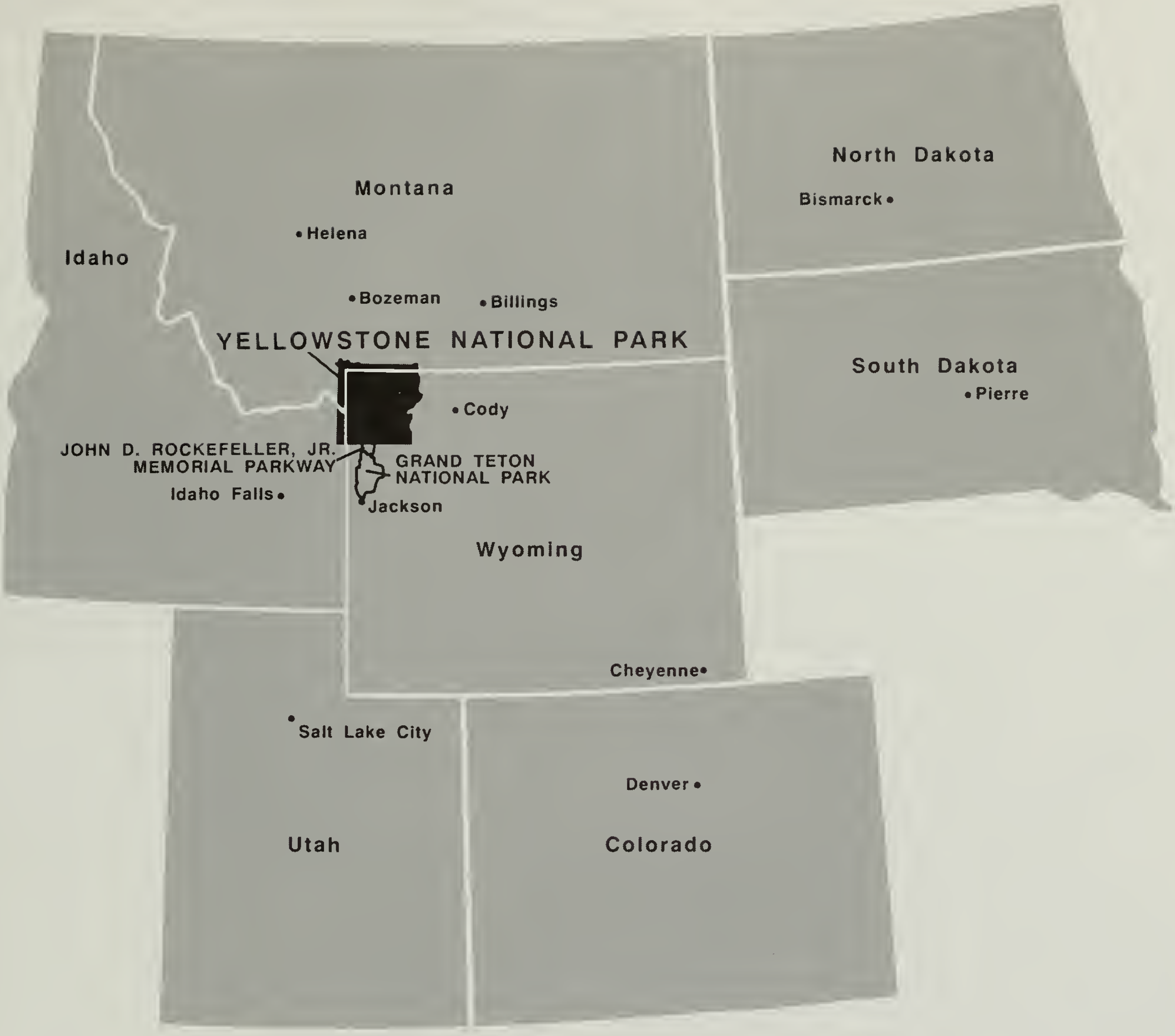
The Master Plan, Yellowstone National Park (1974) states the following concerning park roads:

> Modifications and improvements initiated since the turn of the century have transformed into a primary through-system what was conceived of as, and remains — in standard and design — a secondary road circulation system. Developed for the most part in the railroad-stagecoach era by the Army, the park's road system is now overburdened due to the phenomenal growth of automobile travel, for which

> it was never designed. Complicating the problem and frustrating the solution is the fact that Yellowstone National Park's interior roads also serve as the strategic keystone to the region's limited internal transportation network. . . . With completion of the impact-area bypasses, the existing road system will be adequate to serve current visitor travel to the park.

The Greater Yellowstone Cooperative Regional Transportation Study was an intensive, three-year effort to examine the regional transportation system and present alternatives for access to and circulation within the region over the next 20 years. The *Final Report: Assessment of Alternatives* (February 1979) was the culmination of that effort. The conclusion was that "the existing transportation system has the capacity to meet future needs, with minor improvements to relieve congestion." In accordance with the direction given in these plans, this Environmental Assessment (EA) evaluates alternatives that retain the existing road network in its present configuration.

Surfacing material used to construct the present park road system was obtained from sources within Yellowstone. Very few of these sources are still used for the production of the aggregates needed for the continuing park capital improvement and maintenance programs. Some of the abandoned material sites have been adapted to secondary uses such as administrative or maintenance operations areas, material or equipment storage yards, and debris disposal areas. Some sites have been partially or totally reclaimed and blend into the adjacent scene, but most evidence scars that, while hidden from public view, intrude upon and detract from the natural beauty of the area. In certain instances, temporary reactivation of a material site under a predetermined plan of operation and reclamation would mitigate or erase unsightly and long-lasting landscape scars.



ROCKY MOUNTAIN REGION

YELLOWSTONE NATIONAL PARK

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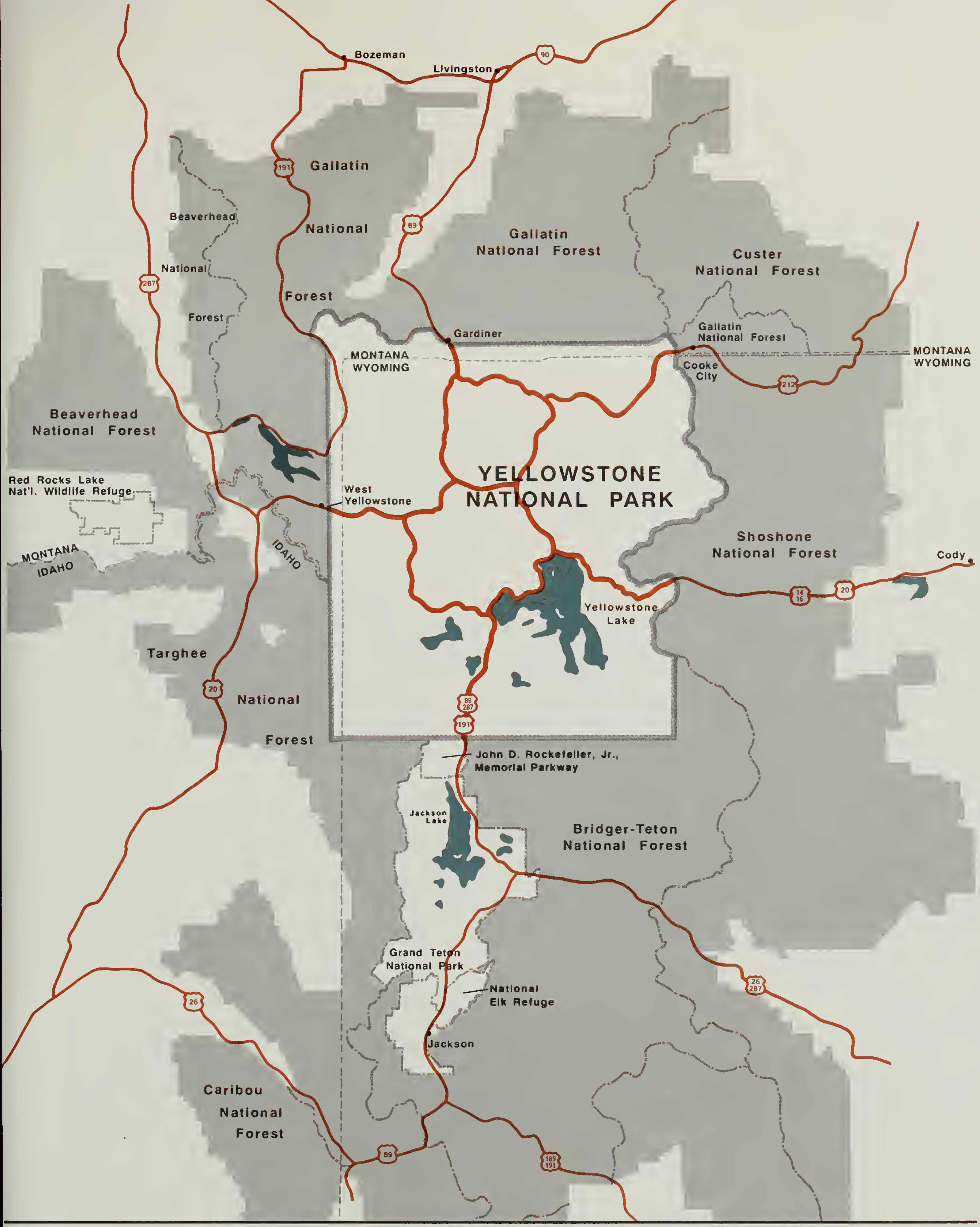

GREATER YELLOWSTONE AREA

YELLOWSTONE NATIONAL PARK

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PURPOSE OF AND NEED FOR THE PLAN

The intent of the proposed parkwide road improvement plan is to preserve and extend the service life of principal park roads, enhance their safety, and continue access to Yellowstone National Park and its features.

NEED FOR ROAD IMPROVEMENT

A substantial portion of the Yellowstone principal road system is in critical need of improvement. Much of the 329-mile system of paved roads is structurally and/or functionally deficient. The FHWA evaluation made in 1988 rated only 28.4% of the road system in good or fairly good condition (FHWA 1990); the remaining 71.6% of the system was rated from fair to very poor condition. In addition to the low structural quality of most roads, bridges are in need of repair and road shoulders are inadequate for modern travel. The roads have deteriorated to such an extent that Yellowstone's cyclic road program (less than $1.0 million per year) is used mainly for patching and stop-gap repairs.

The roads were not designed to safely handle the vehicle mix (including bicycle riders) nor the heavy volume of traffic they now receive in the six months that they are open each year. The volume of traffic, the variety of vehicles, the skill (or lack thereof) of the drivers, and the poor condition of much of the road system (including road turnoffs and attraction areas) combine to create many dangerous situations. Some of these result in unfortunate consequences. The health and safety of the visiting public as well as the economic viability of the gateway communities and the park community itself are dependent upon a transportation chain with some obviously weak links.

One of the most frequent complaints of park visitors concerns the poor quality of the roads within the park. Park managers, visitors, concessioners, and individuals within the gateway communities realize that without action, continued deterioration of the road system is inevitable. Concerned parties realize that road improvement is required. Disruptive as this may be, forestalling construction would only require greater dollar expenditures and increased negative impacts on visitors and commercial enterprises in the future.

In the past, serious accidents were occasionally caused by the condition of the road system. During the three-year period from January 1, 1982, through December 31, 1984, 1,228 motor vehicle accidents occurred within the park. Twenty-five (or 2 percent) of the total were attributed to road defects. A traffic study completed in 1986 pointed out that park roads with narrow and/or unstable shoulders and park roads with significant defects such as potholes create unsafe driving conditions. The large number of visitor complaints regarding the poor quality of the roads within the park is an indication of a problem that will only become more hazardous unless action is forthcoming.

Road surfaces in Yellowstone are generally in a deteriorated condition due to aging pavement, sub-base failures, and poor drainage (FHWA 1990). Most of the roads were constructed decades ago over old wagon roads. The current number and weight of vehicles and the early opening of roads in the spring was not anticipated. Major improvement of roadbeds is needed. Widths are not adequate for modern travel, which includes bicycle traffic mixed with recreational vehicle use and tour bus traffic. Poorly draining sub-base material retains moisture and has contributed to pavement failure and heaving during the spring thaw.

Many park roads are severely rutted, cracked, and potholed. Existing road widths in the park, with the exception of a few newly reconstructed segments, vary from 22 to 26 feet with minimal or nonexistent paved shoulders. Recreational vehicles up to 8 feet 6 inches wide, with side mirrors extending out another 18 inches on each side, are common throughout the park. The narrow widths require a high degree of driver concentration, and the narrow or nonexistent shoulders provide no recovery zone if a vehicle strays from the pavement. Because there are few paved shoulders, bicycles are ridden in the traffic lanes. The pavement edge often has a sharp drop off, creating a hazardous condition and promoting damage to the pavement edge. Traffic is often backed up by slow-moving vehicles. There are few turnouts to encourage slow vehicles to pull over, and many of the existing turnouts have abrupt pavement edges. Passing is often difficult because of poor sight distance due to roadway curvature and encroaching roadside vegetation. Inadequate sight distance is a hazard to wildlife as well as to motorists. Several inadequate culverts reduce or prevent fish spawning.

Additional elements contributing to the deteriorating condition of the Yellowstone principal road system include: (1) the impact of the substantial number of heavy trucks needed to supply concessioner facilities within the park and to construct and maintain the park infrastructure, (2) extremely variable quality of surfacing and paving aggregates used in the initial construction and periodic rehabilitation of the present road system, which has resulted in degradation and decomposition of in situ surfacing and pavement structures, and (3) inconsistent funding for routine and preventive maintenance programs for park roads, which has resulted in some roadway sections deteriorating to the point where substantial improvement has become necessary (FHWA 1990).

The average service life of the asphalt pavement structure of intermediate-type roads, such as principal park roads, is 15 to 20 years. Then the surface deteriorates and should be rehabilitated by repaving with an asphalt overlay and drainage corrections, shoulder reinforcements, and safety improvements. Asphalt pavement should be maintained by chip-and-seal coat applications on a six- to seven-year cycle. Site reclamation of areas disturbed during construction and reclamation of abandoned material sites requires the preservation of quantities of topsoil, obtained within the park, for plant growth medium.

NEED FOR ROAD MATERIAL SOURCES

A long-term program of improvement and continuing maintenance of the Yellowstone principal park road system would require substantial amounts of raw material suitable for the production of mineral (crushed stone) aggregates, sand, common borrow, and topsoil (collectively referred to in this document as material). Material would be needed for maintaining existing road surfaces, for possible widening of the existing roadbeds, for reinforcing shoulders, and for supplying fill to provide a top width consistent with other recently improved roads in the park.

The quality of raw material used in processing pavement and concrete is important; raw aggregates must be clean, hard, durable stone. The material particle size must be such that a specific grading of material can occur through processing such as crushing or screening. The material cannot be susceptible to chemical change through exposure to air or water. It must also be resistant to degradation or breakdown from weather and loading stresses. Material sources should contain a sufficient quantity of raw material of consistent quality to facilitate extraction and processing in an orderly and economical manner. Reject material, such as fine particles, would be returned to the source during reclamation.

The location of material sources relative to the application point is important due to the high cost of material hauling and high cost to the environment. Many existing commercial suppliers are located far from the park boundary, with a resulting high cost for hauling material to the park in addition to that required within the park. Other direct costs include royalties charged by commercial suppliers and reclamation costs on public land sites (reclamation cost is included in the royalty charged by a commercial supplier).

PURPOSE OF THE PLAN/EA

The FLHP is funded by motor fuel taxes. Over the next 20+ years, some FLHP funds are projected to be budgeted for major reconstruction (MR) as well as resurfacing, restoration, and rehabilitation (3R) projects programmed for Yellowstone. Roads that would be reconstructed eventually would receive 3R treatment as a preventative, short-term, or temporary solution. The effects of the entire program of road improvement are addressed on a parkwide basis to guide decision making and assess cumulative environmental effects. The evaluation of known or potential mineral aggregate sources to satisfy long-term road improvement and maintenance requirements is also essential. Environmental documents will be prepared later to analyze the effects of improving specific road segments. They will incorporate preliminary engineering design data as it is developed, and will also analyze the impacts of obtaining material for the route-specific road projects.

This parkwide road improvement plan/EA describes: 1) overall road improvement needs for principal park roads in Yellowstone, 2) common borrow and mineral aggregate requirements, 3) material sources needed for long-term road reconstruction, rehabilitation, and maintenance, and 4) potential impacts (direct, indirect and cumulative) of road improvement and material extraction in the GYA. Because specific road segment designs have not yet been developed, impacts addressed in this document will necessarily be general in nature.

The study area includes the park as well as public and private lands in the GYA located within approximately 20 miles of the park boundary (see Greater Yellowstone Area map). Potential material source areas were limited to those within 20 miles of the park because hauling costs increase substantially when long distances and steep grades are involved. This plan assumes all paved principal park roads would be improved and that sources of considerable quantities of material would be required. At this time, no construction of new roads or major realignments of existing roads are planned, but certain realignments to avoid environmentally sensitive areas may be considered later.

Road Improvement

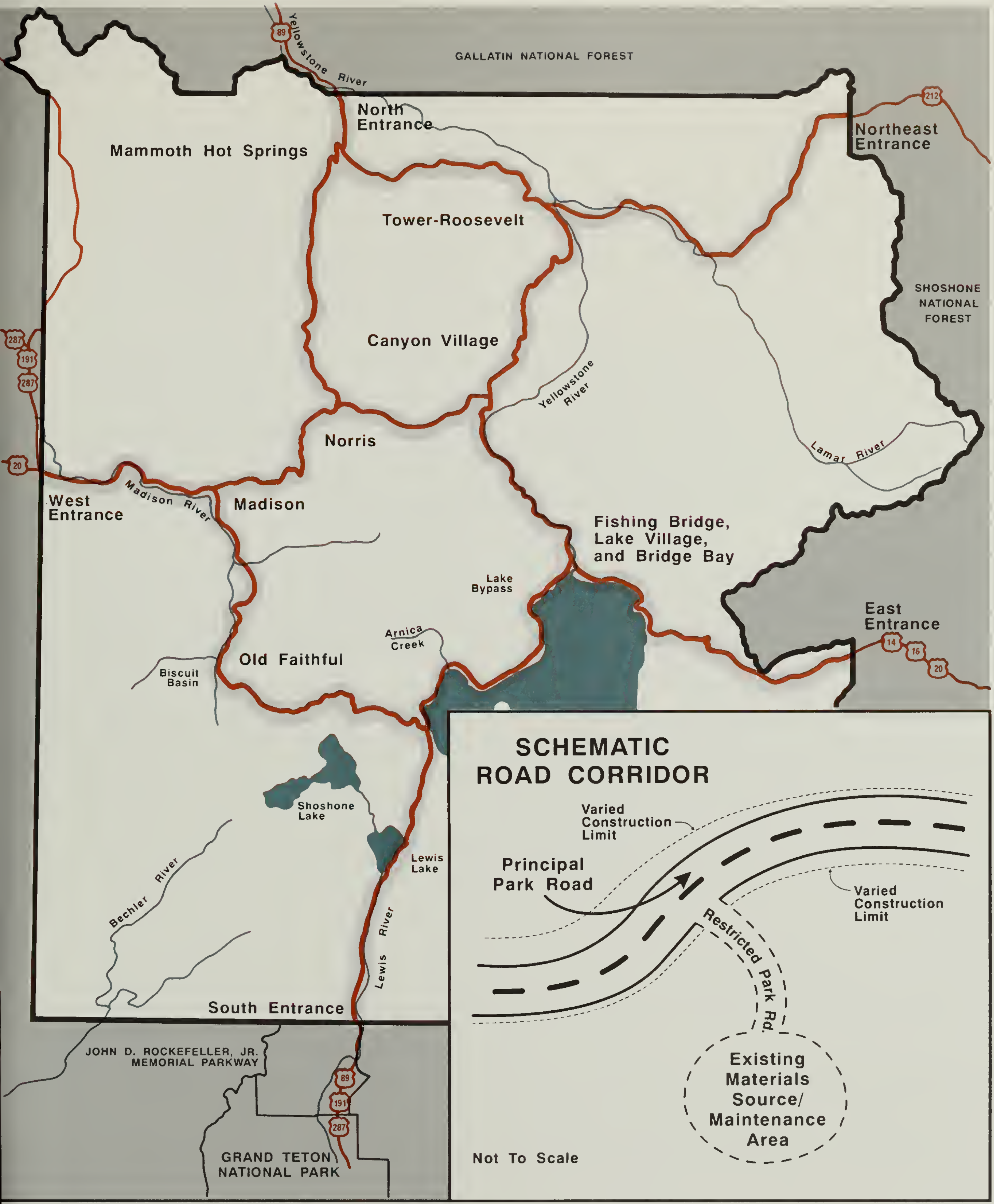
For purposes of functional classification, the routes that make up the park road system were grouped into two categories based on use: public use park roads and administrative park roads (NPS 1985). The assignment of a functional classification to a park road was not based on traffic volumes or design speed, but on the intended use or function of that particular road or route. Principal park roads, the roads proposed for improvement, are one of four classes of public use park roads in Yellowstone. Roads that fall under the other three categories – connector park roads, special purpose park roads, and primitive park roads – are not covered in this plan. They will be addressed in a separate document.

The study area specifically includes the principal park road system with a construction limit (limit of surface disturbance) measured horizontally from the existing ditch line on both sides of the road (see Road Improvement Study Area map). The disturbance width would vary depending on the slope and terrain, and would total approximately 100 feet. Rolling or steep terrain requires cut and fill slopes for road widening in MR, necessitating a wider construction limit than road segments along flat terrain. Whenever possible, road base widening would be confined to one side with the center line shifted accordingly to avoid important historic or natural features or large cut and fill slopes along the roadside. Center line shifts would be dependent on existing geometry and would comply with standard safety design principles. Areas disturbed for construction would be minimized.

Material needs for twenty-two miles of Yellowstone's south entrance road are included in the "Draft Road Material Source Plan/EA, Grand Teton National Park" (NPS 1991d), because of the geographic relation of this area to Grand Teton and the lack of suitable material sources in southern Yellowstone.

Road Material Sources

The FHWA (1990) *Preliminary Draft Material Source Study* identified potential and existing material sources within the park and on lands within 20 miles of park boundaries; potential source areas beyond this range were considered infeasible due to long haul distances with steep grades that would greatly increase transportation costs (see appendix A). The FHWA used technical feasibility criteria (quality and quantity) to evaluate potential reserves and engineering quality of material. Service roads to existing material sites might require grading or other minor preparation or upgrading to allow heavy equipment access to the sites.



ROAD IMPROVEMENT STUDY AREA

N

NO SCALE

ROAD IMPROVEMENT STUDY AREA

YELLOWSTONE NATIONAL PARK

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Sites examined by FHWA included existing sites in the park and sites outside the park in Gallatin County and Park County, MT, Teton County and Park County, WY, and Fremont County, ID. Previously evaluated sites in Grand Teton National Park and the John D. Rockefeller, Jr. Memorial Parkway area (NPS 1991d) were also included; these mineral aggregate sources could potentially supply the southern sector of Yellowstone. The FHWA study also quantified projected road material needs, including estimates for common borrow, for the next 20 years in different areas of the park. These seven "road material areas" were created to facilitate the analysis of material needs to supply road projects in each park area.

A total of 213 potential sources of raw mineral aggregates were investigated by the FHWA. Many of these are existing material source sites (borrow pits) within park boundaries. The majority of these sites are old gravel pits, quarries, or other areas previously disturbed by human activities — some of which were not reclaimed. These sites have varying degrees of plant growth and varying needs for restoration. Restoration cost can be funded with a road improvement project if the material site supplies the project. Sources of restoration funding have been very limited in the past. The state of Wyoming has shown a willingness to assist in the reclamation effort. There is potential for developing existing sites for limited-term material sources. Site restoration would be accomplished at the end of the project.

The FHWA identified several in-park sites as likely for generation of mineral aggregates under a preplanned program of reclamation and revegetation. Eleven general areas or specific sites containing reserves of raw mineral aggregate material also were identified on private or public lands outside of park boundary (FHWA 1990), some as far as 20 miles from the park.

Construction projects in the past have extracted material from riverbeds inside and outside of the park. Stream channels and floodplains are generally recognized as sensitive resources and are not usually suitable as sources for sand, gravel, or borrow. However, under some conditions, use of these areas could result in fewer or shorter-term impacts than alternative upland sources. For example, periodic removal of stream-deposited sand, gravel, and cobble material is often necessary to clear stream channels under highway bridges. This type of material source should be analyzed in conjunction with upland sources in and around the park as material is needed for future route-specific road projects, along with the appropriate compliance and post-extraction monitoring. No new sources would be established on designated wild or scenic rivers.

NATIONAL PARK SERVICE POLICY AND OTHER PLANNING CONSIDERATIONS

National Park Service Management Policies (Chapter 9:4, 1988) provide specific direction on the potential use of park and nonpark mineral aggregate sources:

> Material from borrow pits or other sand or gravel sources on NPS lands, including submerged lands, may be used only by the National Park Service in connection with functions necessary for park administration. Superintendents will only create or use new borrow pits or other sources or continue to use existing sources inside the park if it is determined, based on a written analysis, that economic factors make it totally impractical

> to import sand or gravel and if acceptable sources are identified in the park resource management plan.
>
> When the National Park Service must obtain borrow material or create spoil areas within a park, it will use areas devoid of significant cultural and natural resources, as identified through appropriate studies, and areas not viewed or used by visitors. Such areas will be restored to be compatible with the surrounding environment. All proposals for obtaining material from a previously unused source within a park will be reviewed under all pertinent environmental statutes, including the National Environmental Policy Act (42 USC 4321 et seq.), the National Historic Preservation Act (16 USC 470 et seq.), the Endangered Species Act (16 USC 1531 et seq.), and the Clean Water Act (33 USC 470 et seq.). All applicable federal, state, and local permits will be obtained prior to the creation and use of new borrow sources.
>
> Proposed borrow pits and spoil areas outside parks will also be evaluated to ensure that use by the National Park Service or its contractors complies with all applicable statutes and regulations and does not negatively impact resources or values inside the park. Such areas will be restored as appropriate.

Additionally, Special Directive 91-6 (see appendix B) provides field direction on interpreting and applying management policy related to NPS use of borrow pits and spoil areas. For example, development of a reclamation plan is necessary before authorizing use of in-park sources of mineral material or continuing use of existing pits. Post-extraction use of the sites also would be defined at the time site disturbance was considered.

The Wilderness Study (NPS 1973) for Yellowstone found ten units totaling 2,016,181 acres of the primitive lands in the park suitable for preservation as wilderness and proposed them for inclusion in the national wilderness preservation system. Wilderness lines usually are drawn on natural features, generally ½ to 1 mile back from the principal park road. Borrow pits are not permitted in designated or proposed wilderness areas, with the exception of small quantity use of borrow for trails, which must be in accordance with an approved wilderness management plan.

A Framework For Coordination of National Parks and National Forests in The Greater Yellowstone Area (GYCC 1991) has been issued by the interagency Greater Yellowstone Coordinating Committee. This plan calls for the inventory of existing sand, rock, and gravel material extraction operations in the GYA; limiting material extraction in parks; reclaiming abandoned pits in both forests and parks; and obtaining material from commercial sources where and when practicable.

OTHER PUBLIC SECTOR CONSTRUCTION PROGRAMS IN THE GYA

State- and county-maintained roads in the GYA have improvement and maintenance requirements similar to those of park roads, with material needs that are comparable to those of the Park Service. Long-term material sources to supply state and county highway needs have not been identified.

Construction by the Wyoming Highway Department continues on State Route 292 (Chief Joseph Highway) over Dead Indian Pass between Cody, Wyoming, and Cooke City, Montana. Additionally, the Wyoming Highway Department, in conjunction with the U.S. Forest Service (USFS), is preparing an Environmental Impact Statement (EIS) for the proposed reconstruction of the North Fork Highway (U.S. 14/20) west of Cody, from the east boundary of the forest to the east entrance of the park. The two upcoming NPS route-specific road projects, Fishing Bridge to the east entrance and West Thumb to Arnica Creek, will be coordinated with the state's road improvement projects to address issues such as socioeconomics, traffic management, and cumulative effects.

OTHER CONSTRUCTION/MAINTENANCE PROJECTS IN YELLOWSTONE

In addition to the proposed improvement of the park's principal road system, numerous other projects are ongoing in the park, ranging from concessions projects and natural resource projects to housing and utility construction/maintenance projects. A sample of 1991 park activities is given below.

1. Concessioner buildings — removal of several structures, expansion of facilities, and addition of new facilities.
2. Roadside hazardous tree removal
3. Fire rehabilitation — along roadsides
4. Trailer housing replacement
5. Water, sewer, heating — repair and replacement of lines/units
6. Roads, utilities, and revegetation projects required for housing and concessions activities, and the wastewater plant
7. Construction of facilities as described in the winter use plan (NPS 1990b)
8. Road construction/maintenance of park roads other than principal park roads (includes connector, special purpose, and administrative access roads)

AFFECTED ENVIRONMENT

REGIONAL OVERVIEW

Greater Yellowstone Area (GYA)

The GYA encompasses about 11.7 million acres of national forests and parks, plus lands managed or owned by the Fish and Wildlife Service, Bureau of Land Management (BLM), the states of Wyoming, Montana, and Idaho, and numerous private landholders. The GYA is world renowned for its scenery, wildlife, wilderness, rivers, fishing, hunting, outdoor recreation opportunities, and geologic and thermal features.

The area is traversed by county, state, NPS, and USFS roads (see Greater Yellowstone Area map). The network of roads in the GYA affects nearly all resource-related activities (GYCC 1987). Park roads are maintained to serve a variety of purposes including touring and sightseeing, access to recreational facilities, administrative uses, access to trailheads, and fire suppression. In winter, park roads are closed to wheeled vehicles, except for the roads from Mammoth to Gardiner, Mammoth to Cooke City, and the John D. Rockefeller, Jr. Memorial Parkway through Grand Teton National Park.

Mineral extraction activities were a part of the GYA prior to the creation of the national park. In the 1850s and 1860s, prospectors wandered the region in search of gold. In the late 1800s and early 1900s, small coal mines were locally successful in some areas, including Yellowstone, where the U.S. Army mined coal to heat Fort Yellowstone.

About 60 percent of the lands in the GYA are closed to mineral leasing and mineral entry. Nevertheless, mining, logging, grazing, farming, and development of oil, gas, and geothermal resources take place on private and public lands surrounding Yellowstone (NPS 1991c). Mineral leasing and development is a permitted use of national forests, but national forest wilderness areas are closed to leasing and other mineral activity. Areas related to sensitive thermal features also are unavailable for oil and gas or geothermal leasing. In areas open to mineral leasing, stipulations are attached to leases to protect the surface resources from impacts that might result from exploration or development. The availability of national forest lands for mineral leasing and the stipulations required depend on the direction mandated in forest plans.

Yellowstone National Park

The 2,221,772 acres in the park fall into two general zones — the natural zone and the park development zone. The natural zone encompasses those lands classified as wilderness in the park's wilderness recommendation of 1972 and includes 90 percent of the park. Lands and waters in this zone are characterized by their primeval nature, lack of facilities, and low level of visitor use. The lands within the park development zone encompass a variety of uses and fall into two broad categories, developed areas and transportation corridors. This zone comprises about 10 percent of Yellowstone, although less than 5 percent of the park is actually developed.

Yellowstone contains approximately 539 equivalent-miles (22-feet wide, 1-mile long) of road, including the 43 miles of the Beartooth Highway that are maintained as a part of the Park Approach Road Act of 1931. Of this total, 410 miles are paved roadways, 73 miles are gravel or dirt roads, and 56 miles are equivalent-miles of parking areas and pullouts throughout the park.

The rationale for the Yellowstone principal park road system was implicit in the legislation that established the park in 1872. Yellowstone was "set apart as a public park or pleasuring-ground for the benefit and enjoyment of the people." The early caretakers sought to blend the man-made features of the road with the surrounding landscape.

Two of the early superintendents of the park, Nathaniel P. Langford and Philetus W. Norris, conceived the notion of a grand loop road design during the first decade of the park's existence. The two most noted implementers of this design were U.S. Army officers for the Corps of Engineers, Daniel C. Kingman and Hiram M. Chittenden. By 1882, 104 miles of the projected 140 miles of the Grand Loop Road were finished. Kingman and Chittenden had developed on their own a philosophy of harmonizing man-made features of the road with the landscape. The Corps of Engineers directed park road building and repair from 1883 till 1918 when the National Park Service landscape architects took over and enhanced the design philosophy. Beyond this, a major aspect of the grand loop design was to provide accessibility for the public to the significant wonders and scenic areas of the park.

The road that evolved into the North Entrance road was actually part of an early route to the Cooke City mines, and as such began its first development in 1871, the year before the park was established. The first rail connection outside the park to this north road was completed in the 1880s. The earliest roads in the park were little more than pack trails and evolved gradually into wagon roads and finally into automobile roads. The West Entrance road was completed next in 1873, and together with the northern route was most favored by tourists for at least thirty years. Development of the South Entrance road began in the 1890s, and even though it was completed by the turn of the century, it was little used until the era of the automobile. The East Entrance road was completed in 1903. The Northeast Entrance road, or its earliest embodiment, was more a route to the Cooke City mines than a route for tourists. This road, plus the development at the northeast entrance to the park, was a result of the Beartooth Highway being opened and established as an entrance road in the 1930s.

All segments of the road evolved from narrow pack trails to wider wagon roads to even wider automobile roads over a 120-year span. Even though portions of the original road were abandoned, segments were realigned, and curves and grades were made safer, the basic outline of the original grand loop design remains intact. The engineers of every era were obliged to fight the rugged terrain with the tools of their time, and were able to achieve the basic objective of making accessible the wonders and scenic beauties of Yellowstone.

NATURAL RESOURCES

Geology and Thermal Areas

Past geological events have created the unique landscape of Yellowstone National Park. The collision of the North American continent with the Pacific Ocean floor caused the uplift and building of the Rocky Mountains. The Absaroka Range was formed later from lava and ash flows during one of several volcanic periods 40-50 million years ago. Further episodes of volcanism produced the Yellowstone Plateau volcanic field and included eruptions that formed several calderas, one of which enveloped a large, central portion of the park. Two periods of glaciation further shaped the park's topography after the last volcanic eruption.

One outcome of these past geological events was the deposition of various rock types and surface material in the park such as: surficial deposits of soil and rock material that have been left by receding glaciers or deposited by running water or wind, rhyolitic tuffs and flows, and andesitic tuffs and flows. Many of the structural problems of the present park road system and the challenges of road building and maintenance are caused by the underlying material.

The park is still very geologically active today. The average uplift between 1923 and 1964 was about 0.6 of an inch per year. Since 1984, however, the area has actually been receding at a rate of 20 millimeters per year (0.08 inches). Geologic benchmarks have been placed along the Grand Loop Road by the Cascades Volcano Observatory of the U.S. Geological Survey and are used annually for volcano deformation studies to precisely measure minute changes that may indicate volcanic activity and explosion potential.

Hot magma deep within the earth's surface from past volcanic periods still heats water for all the park's hot springs, geysers, mud pots, and fumaroles. Approximately 120 thermal areas have been identified within the park including Steamboat Point, Mud Volcano, Mammoth Hot Springs, Norris Geyser Basin, Lower Geyser Basin, Midway Geyser Basin, Biscuit Basin, Upper Geyser Basin (including Old Faithful), and Black Sand Basin. Infrared aerial images of potential thermal activity were recently developed for the park. This information, in addition to ground surveys and evaluations, would be used in locating potential hot spots within the park road system during preparation of route-specific environmental documents.

Topography and Soils

The topographic setting for Yellowstone is primarily a complex of uplifted mountains of sedimentary rocks and the aftermath of two major volcanic events. The park is characterized by several broad, forested volcanic plateaus surrounded by the Absaroka mountain range on the east, the Gallatin mountain range on the north, and the Red Mountains on the south. Elevations range from 5,200 feet to over 11,000 feet and average 8,000 feet. The continental divide traverses southwestern Yellowstone. Yellowstone, Shoshone, Lewis, and Heart Lakes dominate much of the plateau country, covering 108,000 acres. The Yellowstone and Snake rivers flow through the park. The Lewis, Gibbon, Firehole, Gardner, and Lamar rivers flow from their sources in Yellowstone; the Madison forms at the confluence of the Firehole and Gibbon Rivers.

The central part of the park is underlain by rhyolitic volcanic rocks; most of the remainder is underlain by andesitic volcanic rocks. Soils that developed from these two distinct rock types differ in mineral nutrient content and water-holding capacity, both factors of primary importance to plants. Rhyolitic soils tend to dry out more quickly and are generally very poor in plant nutrients. Andesitic soils generally are higher in organic matter, silt, and clay, and provide water for most of the growing season and better growing conditions for plants. A small portion of the soils are derived from sedimentary sources: limestones, sandstones, and shales.

The park road system lies mostly in river valleys on the high volcanic plateau, with several passes over higher mountain ranges. The major river valleys are significant features in the pattern of the road system. These river valleys harbor many of the wetlands and thermal features.

Vegetation

There are three major vegetation zones in Yellowstone: the spruce/fir zone, the lodgepole pine zone, and the Douglas-fir zone. The spruce/fir zone is dominated by forests composed of Engelmann spruce and subalpine fir, and can be composed of all growth stages from young to mature stands. Young stands are typically dominated by lodgepole pine, which gives way to spruce and fir as the stand matures. Older stands can have a mixture of spruce and fir with lodgepole pine and, at higher elevations, whitebark pine. These forests grow predominantly in andesitic soils.

The lodgepole pine zone is dominated by lodgepole pine, with very little spruce and fir present. However, whitebark pine may be present in all age stands. These forests grow predominantly on rhyolitic soils.

The Douglas-fir zone is dominated by Douglas-fir, with snowberry understory common in younger stands. Douglas-fir stands are frequently intermixed with stands of sagebrush and grasses.

Specific vegetation classifications for Yellowstone have been further refined in a detailed vegetation cover and habitat study (Despain 1990). Despain has defined six cover types and 19 forested and 18 nonforested habitat types within Yellowstone. Distribution of habitat types is determined by physical conditions such as soil, water, temperature, light, etc.; however, the two major factors determining habitat types are moisture and temperature. Disturbance factors such as fires, volcanic activity, and landslides are additional factors that determine the plants (cover types) likely to be present.

Broad vegetation patterns are related to the underlying rock in Yellowstone. The drier subalpine fir and lodgepole pine types are associated with rhyolite. Rhyolitic substrates are covered with a nearly continuous forest, and andesitic substrates have a much higher incidence of meadows. The wetland vegetation types generally avoid both rhyolitic and andesitic bedrock types, probably because of topographic factors. However, wetland areas can be associated with the fringes of rhyolitic areas and depressions of andesitic areas.

There are numerous rare plant species listed with the Wyoming and Montana Heritage Programs. There are no major roads or material sites located in Idaho within Yellowstone, therefore no rare Idaho plants would be involved.

Wildlife

Yellowstone is home to a wide variety of wildlife. Over sixty species of mammals, hundreds of species of birds, six species of reptiles, four species of amphibians, and many native and introduced species of fish inhabit the park.

Mammals. Mammals present in the park include elk, bison, moose, mule deer, white-tailed deer, pronghorn, bighorn sheep, grizzly bear, black bear, coyote, red fox, pine marten, weasel, bobcat, river otter, snowshoe hare, beaver, muskrat, porcupine, marmot, tree and ground squirrels, and other small rodents. Cougar and wolverine live in the park and lynx may be present.

Elk are the most abundant of the ungulates in the park. Seven or eight major elk herds summer in Yellowstone. This population is estimated at about 30,000. The northern herd uses the area from Mammoth south to Norris extensively. Most of the other herds summer in other quadrants of the park. Elk often concentrate in areas visible to motorists, providing important viewing opportunities for visitors. The breeding season occurs from September through October. Nine months later, calving takes place on the winter range from about mid-May through late June.

Yellowstone supports between 2500-3300 bison. This population separates into three wintering units: Lamar, Pelican, and Mary Mountain (Hayden Valley-Firehole). These subgroups move to wintering valleys about mid-November. The return to summer ranges occurs in late May or early June. Hayden Valley is heavily used by bison during the summer. Seasonal movements in the large areas follow regular, repetitive patterns. The breeding season begins from mid- to late July and essentially is over by late August or early September. The majority of calves, usually single births, are born on the wintering area during the first two weeks of May.

Moose in Yellowstone are found mainly on the northern range and around the upper Yellowstone River in floodplain willow vegetation. They also occur in the Falls, Snake, Bechler, and Gallatin river drainages. Moose are particularly visible around Fishing Bridge, through Hayden Valley, and near Indian Creek Campground and Lewis Lake. The current population estimate for the northern range is 430.

Bighorn sheep in Yellowstone are most frequently observed during winter on the slopes of Mount Everts east of the Gardner River. Isolated bands also spend winters at higher elevations scattered about the northern portion of the park. In the summer bighorn are found along the slopes of Mt.

Washburn between the developed areas of Tower and Canyon Village. About 293 individuals were counted in 1988.

Mule deer and pronghorn also inhabit the park but are not as abundant as elk and bison. During the spring of 1991, approximately 2100 mule deer and 600 pronghorn were counted during population surveys. Mule deer make use of suitable habitat along the entire Grand Loop Road during the summer; pronghorn tend to concentrate in the northern portion of the park from Mammoth to the northeast entrance during the summer and north of Gardiner, Montana, during the winter.

White-tailed deer are seldom seen although a few narrow strips of summer range exist along the northern boundary of the park.

Small numbers of mountain goats have increasingly been observed, especially in the northeast and northwest corners of the park. These animals are presumed to be moving in from herds transplanted outside the park for potential hunting stock.

Black bears are widespread. They are frequently observed from Mammoth to Tower to the northeast entrance, south of Tower to the north side of Dunraven Pass, and from Mammoth through the Swan Lake Flats along the park road system. Black bears are also found to a lesser degree around the Canyon and Madison areas.

Most of Yellowstone's wildlife use the habitat around the principal park road system in some way. Some, such as small ground- or tree-dwelling rodents, use the corridor as their home territory; others, such as bison and elk, feed near the roadway; and some, such as bears and coyotes, traverse the road during their daily and seasonal movements to reach food, water, and cover. Each segment and potential material site area would be evaluated in greater detail in regard to use by and value to wildlife in future route-specific environmental documents.

Birds. The birds that occur in Yellowstone include Canada geese, American white pelicans, Caspian terns, sandhill cranes, gulls, great gray owls, ospreys, golden eagles, and various waterfowl and passerine species. Most birds found in the park come in contact with the road corridor as they fly over the area or when they feed, hunt, and nest along the roadway. For example, cliff-nesting birds nest at Overhanging Cliff along the road from Tower to Canyon and under the bridges in Hayden Valley. Shorebirds use the mudflats created by the large accumulation of sediment west of the road at Alum Creek between Canyon and Lake. Waterfowl also extensively use the areas west of the road at No Name Lake between Lake and West Thumb. These examples of heavy use are by no means comprehensive. Many other areas along the Grand Loop Road and near potential material sites are important to birds and would be analyzed in greater detail in the specific environmental documents for individual projects.

Fish. The native Yellowstone cutthroat trout is the only trout species that occurs in Yellowstone Lake and its tributaries in the GYA. In fact, Yellowstone Lake supports the largest inland population of cutthroat trout in the world. From May to July, mature Yellowstone cutthroat ascend

68 of the 124 tributaries. Many of these tributaries pass under the Grand Loop Road primarily on the east side of the park and some of the culverts present barriers to upstream trout passage. After spawning, upstream movement most often occurs during daylight hours; downstream movement occurs mainly at night. Spawners in Yellowstone Lake tributaries spend between six and 25 days in the stream. Males generally migrate earlier than females and remain longer. Eggs typically hatch in 25 to 30 days.

Other notable native species include the Arctic grayling and mountain whitefish. Non-native species were introduced in the late 1800s into some drainages of the greater Yellowstone area and in certain cases replaced the native species through competition. Non-native fishes include, among others, the brook, brown, rainbow, and lake trout, longnose sucker, and redside shiner. The rainbow trout spawns in the spring, similar to the Yellowstone cutthroat; the brook, brown, and lake trout are fall spawners. The longnose sucker and redside shiner successfully cohabit with Yellowstone cutthroat in Yellowstone Lake. Many streams that support populations of these species pass under or are situated adjacent to the Grand Loop Road and vicinity.

Threatened and Endangered Species

Four species listed under provisions of the Endangered Species Act of 1973 (as amended) are present in Yellowstone National Park. The grizzly bear (*Ursus arctos horribilis*) is classified as threatened. The bald eagle (*Haliaeetus leucocephalus*), the peregrine falcon (*Falco peregrinus*), and the whooping crane (*Grus americana*) are listed as endangered. There are no federally listed threatened or endangered plants in Yellowstone.

Grizzly Bear. In 1975 the grizzly bear was classified under the Endangered Species Act as a threatened species in the contiguous United States. Less than 1000 grizzlies in six distinct areas of Montana, Wyoming, Idaho, and Washington are thought to survive today. The grizzly bear population of the Greater Yellowstone ecosystem, which encompasses Yellowstone National Park and neighboring federal, state, and private lands, has been identified as the first priority among those populations selected for recovery efforts in the revised *Grizzly Bear Recovery Plan* (FWS 1990), the basic management document guiding the effort to restore the grizzly bear populations in the lower 48 states to viable level (see Grizzly Bear Recovery Zone map). Consequently, preservation of the grizzly bear and its habitat is one of the highest priorities for park management. The entire park, with the exception of small tracts surrounding developed areas, is designated a Management Situation 1: grizzly habitat and its improvement receive the highest priority, management decisions favor the needs of the grizzly bear when grizzly habitat and other uses compete, and land uses that can affect grizzlies and their habitat are made compatible with grizzly needs, mitigated, or eliminated.

The *Grizzly Bear Recovery Plan* set a total Yellowstone ecosystem population of 301 bears, averaged over six years, as the recovery goal. Population estimates have been highly controversial because bears are extremely difficult to count. The most recent estimate, a minimum of 183 to 207 bears, was calculated based on counts of females with cubs and other population parameters that can be accurately measured (Knight et al. 1983). Population trends have also been difficult to identify. The analysis for 1974-1980 showed a decline of 4.2 percent per year. Studies of grizzly bear population dynamics in Yellowstone and the analysis of the relationship between human activities and grizzly bear welfare suggest that the two major factors affecting grizzly bear recovery and long-term survival are displacement of bears from prime habitat and human-caused deaths of bears. The difference between a stable or increasing population and a declining population in the Yellowstone ecosystem may hinge on the additional mortality of only one or two adult females per year. If the GYA maintains sufficient habitat available to support a viable population of grizzlies and if bear mortalities are minimized, especially those of breeding females, it should be possible to protect this threatened population and to aid in its recovery.

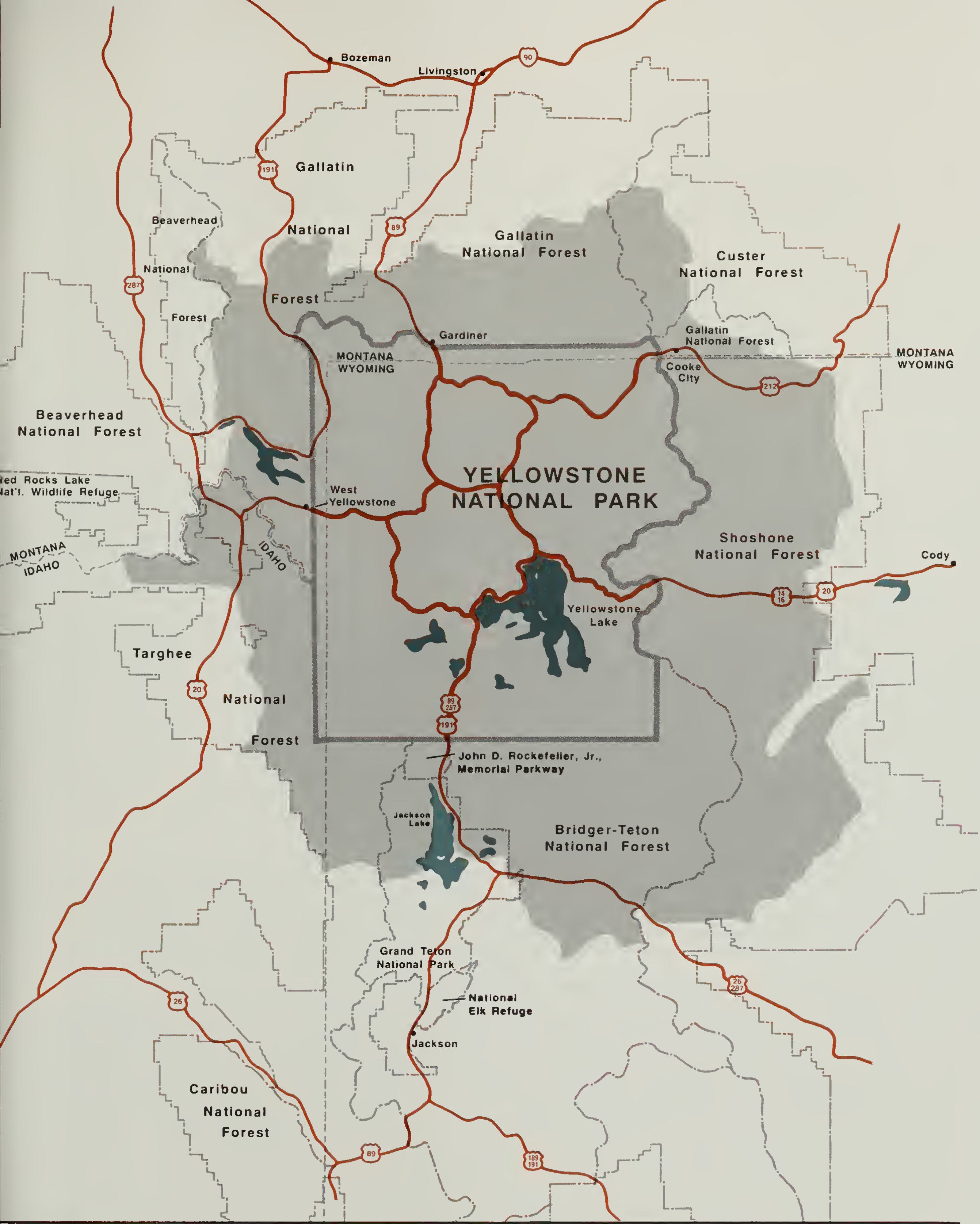
Grizzly bear use of the park appears to be widespread, with areas of high density occurring at various places throughout the park. Areas along the road segments from the east entrance to Fishing Bridge to Canyon to Tower and the eastern half of the Northeast Entrance Road are important to grizzlies during spring, summer, and fall. The Fishing Bridge to Sand Point Picnic Area, Pumice Point Service Road junction to West Thumb, Old Faithful to Madison road segment, the Gallatin Highway, and area around Norris are also important during the spring.

Grizzlies must feed undisturbed in preferred areas with high quality foods in order to meet nutritional requirements when they emerge from hibernation in mid-March. From March through May they are highly dependent on preferred spring ranges providing carrion (carcasses of winter-killed animals) and succulent herbaceous plants. Grizzly bears also prey upon winter-weakened animals, elk calves, and spawning cutthroat trout. Elk calving on the winter range takes place from about mid-May through late June, making newborn calves an available food source for grizzlies from about mid-May to early July. Cutthroat trout spawning usually begins in late April and can extend into early August. Grizzlies feed on cutthroat trout throughout the spawning period although predation on spawning trout reaches highest levels one to two weeks after the spawning peak.

Grizzlies feed on succulent vegetation and moths from mid-summer through fall in high elevation meadows. Whitebark pine nuts from squirrel caches become the most important diet component later in the fall and, in addition to other autumn food sources, are essential to the accumulation of fat reserves. Grizzlies select a den site by late fall and normally hibernate by late November or early December.

Grizzlies are active day and night during early spring and autumn when food is relatively scarce. Most rest during daylight hours and feed at dawn, dusk, and night from late spring through summer when food is relatively abundant. Grizzlies are highly mobile and cross road corridors in search of food sources.

Human presence or developments may affect grizzly bears by displacing them from an area or a food source that might otherwise be used in the absence of human activity. The degree of displacement depends on the type, timing, and intensity of human activity; natural barriers, such as heavy forest cover, hills, or ridges; the season; the quality and availability of bear foods at that time; and the nature of the bears using the area. Avoidance of humans by bears appears to take



▨ RECOVERY ZONE

N

NO SCALE

GRIZZLY BEAR RECOVERY ZONE

YELLOWSTONE NATIONAL PARK

UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE
DSC / FEB '92 / 101 / 40258A

two forms — disruption of foraging activities and outright avoidance of areas near frontcountry facilities. Avoidance of humans using roads and developments probably exacts a cost on the grizzly bear population. Adult female and subadult grizzlies appear to endure a disproportionate part of this cost.

Bald Eagle. Bald eagles are endemic to North America and are found throughout the park. They are year-round residents as well as migrants. Sixteen breeding pairs of bald eagles currently inhabit the park. Resident bald eagles begin defending territories in late January, display courtship behavior in February, and begin nesting, laying eggs, and incubating in March and April. Nests are found exclusively in large, mature trees close to water, primarily along the margins of Yellowstone Lake and several rivers in the park. Chicks begin hatching in May and fledging in July. Bald eagles are most sensitive to human activity during the nesting period.

The bald eagle preys on waterfowl and fish during the nesting season, and on waterfowl and carrion during the winter months. Some pairs leave their nesting territories for short periods of time to take up temporary residence at lower elevations where food is more abundant because of severe winter weather. Migrant bald and golden eagles join resident eagles in the communal winter areas in and around Yellowstone.

Bald eagles use large snags to hunt along the Grand Loop Road from Canyon to Lake, near Bridge Bay from Lake to West Thumb, along Lewis River from West Thumb to South Entrance, and the Old Gardiner Road. Other areas along the road corridor and around potential material sites are undoubtedly used by bald eagles; these will be examined in further detail in the route-specific environmental documents.

Peregrine Falcon. The peregrine falcon, a species native to the park, resides in Yellowstone from April through October, nesting on large cliffs that overlook rivers or valleys where prey is abundant. Peregrines travel hundreds, even thousands, of miles as they migrate to and from summering areas like Yellowstone.

Hacking (peregrine reintroduction) was begun in 1984 as part of the American Peregrine Falcon Recovery Plan (USFWS 1984). Surveys and monitoring of reintroduced birds in 1987 revealed that suitable sites were being naturally reoccupied in the park. Hacking ceased after 1988 because suitable peregrine habitat was thought to be saturated. Known peregrine eyries in the park have increased from one in 1984 to six in 1991.

Whooping Crane. Whooping cranes are summer migrants in Yellowstone. The whooping crane population in the Greater Yellowstone ecosystem is centered at Gray's Lake National Wildlife Refuge in Idaho. Historical evidence of whooping cranes nesting in Yellowstone does exist, but the Yellowstone nesting information is sketchy and does not constitute a legitimate nesting record. The whooping crane population in the park is usually extremely low, rarely if ever exceeding two individuals. The two whooping cranes known to summer in the southern half of the park in recent years do not constitute a viable population.

Candidate Species. The following species are Category 2 species — species for which current information indicates that listing as threatened or endangered is possibly appropriate, but for which conclusive data needed on biological vulnerability and threat are not available.

The wolverine (*Gulo luscus*) is a wide-ranging, mid-sized carnivore, generally solitary in nature, that preys or scavenges on other mammals, such as ungulates. Some evidence suggest that a breeding population exists in the GYA, although abundance and distribution have not been documented. Wolverine reported in the park may occur seasonally or have home ranges which extend beyond park boundaries.

The lynx (*Felis lynx*), a mid-sized carnivore, is wide-ranging, uses habitat in dense forests away from traveled areas, is generally solitary in nature, and preys or scavenges on other mammals. The lynx' resident breeding status in the park is uncertain, although sightings have been reported throughout the park's history. It is generally impossible to verify the reliability of sightings, particularly since the bobcat, a species similar in appearance, is present.

The spotted bat (*Euderma maculatum*) has not been documented in Yellowstone, although suitable habitat exists in the park. The western big-eared bat (*Plecotus townsendii*), which generally lives in caves, has been collected in the Mammoth area and may be widely distributed in the park.

One verified specimen of Preble's shrew (*Sorex preblei*) was trapped years ago in the park. An attempt in 1986 to capture more specimens in an area near the Lamar Ranger Station did not result in any new specimens. The shrew favors sage/bunch grass communities. Additionally, riparian corridors through varying habitats could serve as a migration corridor. No information exists on its distribution or abundance in the park.

The Arctic grayling (*Thymallus arcticus*) exists in several lakes in Yellowstone. A fluvial form historically occurred in the Madison River drainage and below the barrier falls in the Firehole and Gibbon rivers. The fluvial Arctic grayling is now very rare in the upper Missouri River basin and may no longer occur in Yellowstone. The park is considering a plan to restore fluvial Arctic grayling in several streams.

Category 2 bird species include the ferruginous hawk (*Buteo regalis*), the mountain plover (*Charadrius montanus*), the long-billed curlew (*Numenius americanus*), and the burrowing owl (*Athene cunicularia*), all of which are rarely recorded in the park. Further biological research and field study might be needed to ascertain the status of these and other candidate species for each route-specific environmental document.

Two plant species are now or soon will be federally listed as Category 2. These species should be considered and protected in the same manner as threatened or endangered species. The plants are Ross's bentgrass (*Agrostis rossiae*), and a sand verbena (*Abronia ammonphila*). Ross's bentgrass is currently found in the lower geyser basin near roads, and this sand verbena is found on sand bars at the edges of lakes and streams in the Yellowstone Lake area.

Species of Special Management Concern. The trumpeter swan (*Cygnus buccinator*) is a species of special management concern in Yellowstone and in the state of Wyoming. Some trumpeter swans remain in the area all year and are joined by winter migrants. About nine pairs nest in Yellowstone. In winter the population increases to between 40 and 300, depending on the number of migrants. The slow-flowing, open water habitat required for swan survival can increase with thermal activity, but even in Yellowstone this habitat becomes scarce during the coldest part of winter. Swans are easily disturbed during breeding and egg-laying. They are also sensitive to disturbance during incubation, which occurs from mid- to late June. Juvenile swans mature slowly and fledge late. The severe climate of the GYA often results in poor reproduction and makes this area marginal swan habitat.

Water Resources and Quality

Yellowstone National Park encompasses a 3,500-square-mile watershed that preserves one of the most significant and near-pristine aquatic environments in the United States. The surface water resources of Yellowstone include 604 streams comprising 3,785 miles of running water, and 175 lakes with a total surface area of 108,000 acres. Headwaters of the Missouri and Columbia Rivers originate along the continental divide in Yellowstone National Park. Water quality in the park has the potential to be affected by both natural processes and human activities. Natural influences include hydrothermal discharge, wildlife, fire, and storm runoff.

Streams and lakes are designated as Class I by the state of Wyoming primarily for the purpose of wastewater discharge. Surface waters so designated shall be maintained at their existing quality. No discharges into these waters will be allowed.

There is potential for pollution of the waterways since many roadways parallel streams, rivers, and lakeshores. Motor vehicles present a small potential source, and gasoline tank trucks and construction tank trucks present an even greater potential pollution source from accidents or spills.

Floodplains and Wetlands

Wetland communities in Yellowstone consist of wet forest, shrubby riparian, and grassland riparian habitats. The dominant factor of wetlands is excess water in the soil, which is a major factor in vegetation growth. Wetlands are the most productive vegetation habitat and often will support diverse wildlife populations. Wetlands are protected through congressional legislation. The Clean Water Act of 1977 is the principal wetland protection act, and precludes destruction of wetlands by filling. Various other federal acts are also instrumental in providing protection for wetlands. The Army Corps of Engineers provides the principal administration of the Clean Water Act, with review responsibilities shared by the U.S. Fish and Wildlife Service, the Soil Conservation Service, and the Environmental Protection Agency. In addition, Executive Orders 11988 and 11990 were issued by the president in 1977 requiring federal projects to consider all alternatives and minimize impacts to floodplains and wetlands. More specifically, the NPS procedure for wetland protection is to initially avoid wetlands by consideration of an alternative that avoids any wetland impact. If this solution is not possible, then mitigative measures are to be taken that reduce adverse impacts on wetlands. When this is accomplished, creation of new wetlands or restoration of former wetlands should be implemented to offset losses.

The initial step in wetland protection is identification and inventory of all wetlands. A National Wetland Inventory map has not been completed for Yellowstone. However, satellite imagery has provided information for a Geographic Information System (GIS)-based inventory of all wetlands in excess of five acres. For each road improvement project, a more detailed ground survey should be conducted by NPS staff familiar with wetland criteria.

Wet forest habitat covers about 8 percent of the park. Subalpine fir and Engelmann spruce are dominant. The forest floor is dominated by a variety of wet-site species including horsetails, bluejoint reedgrass, trapper's tea, twisted-stalk, arrowleaf groundsel, and a variety of mosses.

Shrubby riparian habitats are usually dominated by willows and sedges. They are most often distributed along streams and near seeps. Ground cover plants are typically reedgrasses, sedges, cinquefoil, pussytoes, and aster.

Grassland riparian habitats are most often sedge marshes or bogs. Their distribution is usually associated with standing water throughout most of the growing season. The dominant plants are water sedge, inflated sedge, and Nebraska sedge.

Whenever development may involve filling into the waters of the United States, section 404 of the Clean Water Act requires the filing of an application with the Corps of Engineers. Roads and road projects in Yellowstone are administered through the FLHP and jointly managed through the Park Service and the FHWA. By interagency agreement, application for the 404 permit for road projects is prepared by the FHWA.

Air Quality

Yellowstone National Park is designated as a mandatory Class I area under the Clean Air Act, as amended (42 USC 7401 et seq), which means that Yellowstone is charged with protecting air quality values, including visibility, and with ensuring that the airshed is not degraded by either internal or external emissions.

Baseline air quality monitoring has been conducted in the park since at least 1979, when a particulate monitor was installed. Beginning in 1981, visibility was monitored by telephotometer and photography, and a study was completed on sensitivity of soils and waters to acid deposition. In 1980 the park was added to the National Atmospheric Deposition Program (NADP) network. A precipitation and dry-fall collector, pH and conductivity meters, and weighing balance are located at Tower Ranger Station.

In 1986 the NPS Washington, DC, Air Quality Division installed a semi-automated air quality monitoring station at Lake to monitor criteria pollutants against National Ambient Air Quality Standards (NAAQS). This network includes an Interagency Monitoring of Protected Visual Environment (IMPROVE) sampler for the criteria pollutants (ozone, sulfur dioxide, lead, nitrogen dioxide, total suspended particulates, and carbon monoxide); an ozone analyzer and calibrator; and meteorological equipment that measures wind direction, linear and scalar wind speed, dew point, temperature, solar radiation, and precipitation. In 1989 a camera was relocated in the Yellowstone Lake area to help monitor trends in visible air quality.

There are currently no major sources of air pollution in the park vicinity; however, the geothermal resources in the park emit hydrogen sulfide, a noxious gas that can be poisonous in high concentrations. Human-related sources of air pollution include motor vehicles, campfires, fireplaces, wood stoves, boilers for the generation of electricity and steam, and processing of road material. Although vehicular traffic on the roadways is one of the biggest air pollution sources in the park, it is still believed to have a minimal impact on local air quality. Local carbon monoxide levels are less than the national ambient air quality standard of 0.03 percent.

CULTURAL RESOURCES

Archeological Resources

Native Americans occupied the greater Yellowstone area beginning at least 12,000 years ago. Hunting and gathering camps, trails, and obsidian quarries were among the archeological sites found. Although more than 400 archeological sites have been recorded, comprehensive archeological surveys of less than 1 percent of the park have been completed. One site, Obsidian Cliff, has been nominated as a national historic landmark. The majority of the sites have not been evaluated for eligibility to the National Register of Historic Places. Many of Yellowstone's historic sites exist today as archeological sites. (NPS 1991c)

As segments of the principal park road system are scheduled for improvement, particular surveys would be slated to locate and evaluate archeological sites and take appropriate mitigation efforts along those segments. This was done, for example, in 1989 for the east entrance road segment when the NPS Midwest Archeological Center (MWAC) conducted an archeological survey and inventory for the proposed right-of-way (NPS 1990a).

There is a high probability of encountering cultural resources in the area around Gardiner, along the Yellowstone River, and in the area around Obsidian Cliff where there is a very high concentration of known sites.

Historic Resources

Road access to Yellowstone Park and the surrounding area and road transportation within the park was a major concern in the early years. The conception of the grand loop design began during the first decade of the park's existence. Early road development took place under the direction of the U.S. Army Corps of Engineers until the National Park Service assumed responsibility for road construction in 1918. The character of the roads evolved from the era of horse-drawn vehicles to the age of the automobile. One factor that promoted better roads in Yellowstone in the 1920s and beyond was the good working relationship between the Bureau of Public Roads and the National Park Service, but funding shortages perpetually hampered road improvements.

Mission 66, a 10-year NPS plan endorsed by the President and Congress, included several objectives: to bring the neglected physical facilities of the national parks fully up to the needs anticipated by 1966; to preserve and protect the parks; and to make the parks more useable, enjoyable and meaningful for the American people. The problem of visitor impact was growing and great efforts were made to provide the physical plant and staff services necessitated by the increased visitation. Mission 66 relieved the funding situation considerably, bringing badly needed monies to the well-traveled system. The detailed history of the Yellowstone road system is described in a two-volume historic resource study, *The History of the Construction of the Road System in Yellowstone National Park, 1872-1966* (NPS 1991h).

The Yellowstone road system is an important historic resource. The roads lie lightly upon the land, blend into the natural setting, and have evolved into a historic landscape. For more than a hundred years this road system has retained the basic design philosophy as expressed by Hiram Chittenden at the turn of the century:

> It is most important to blend this man-made intrusion with the natural setting in the least objectionable way; but once the intrusion is decided upon, it should be made as perfect as possible, and be an example of its class.

In recognition of the significant historic qualities of the Yellowstone road system, a National Register of Historic Places Multiple Property Documentation Form (1991f) was submitted to the NPS WASO office and the National Register office for a preliminary review in August 1991. Individual forms for these historic properties (districts) were submitted in November 1991 for draft review.

A number of historic districts have been defined in the multiple property form, including the Grand Loop Road, the five entrance roads, and collector roads. A variety of noteworthy structures and features are included as part of this nomination. The following bridges, with Historic American Engineering Record (HAER) numbers in parentheses, are being nominated as contributing resources. Along the Grand Loop road, Mammoth Hot Springs to Madison Junction Section, there are four: (1) Seven-Mile Bridge (WY-28), (2) Obsidian Creek Bridge (WY-10) off the Grand Loop Road on a campground road, (3) Gibbon River Bridge No. 1 (WY-29), and (4) Gibbon River Bridge No. 2 (WY-30). On the section from Madison Junction to Old Faithful, there are two: (1)

Nez Perce Creek Bridge (WY-48) and (2) Firehole River Bridge near Fountain Freight Road (WY-27) and the Grand Loop Road. The South Entrance road section has one — the Crawfish Creek Bridge (WY-26). The Isa Lake Bridge (WY-31), on the Old Faithful to West Thumb road section, has already been determined eligible for the national register.

The Lake Junction to Tower Junction section has three: (1) Tower Creek Bridge (WY-33), (2) Otter Creek Bridge No. 1 (WY-32), and (3) Otter Creek Bridge No. 2 (WY-47), on a campground road near the Grand Loop Road. There are two bridges on the Mammoth Hot Springs to Tower Junction section — Lava Creek Bridge (WY-33) and Gardner River Bridge (WY-7).

There are four on the East Entrance Road: (1) Cub Creek Bridge (WY-25), (2) Sedge Creek Bridge (WY-25), (3) Pelican Creek Bridge (WY-9), and (4) Fishing Bridge (WY__).

The Northeast Entrance Road has seven: (1) Lamar River Bridge (WY-12), (2) Pebble Creek Bridge (WY-40), (3) Soda Butte Creek Bridge No. 1 (WY__), (4) FHWA Creek Bridge (WY-38),(5) RWC Creek Bridge (WY-37), (6) TLF Creek Bridge (WY-36), and (7) Soda Butte Creek Bridge No. 2 (WY-39).

Collector roads submitted include: (1) The Mammoth-Gardiner High Road (3.95 miles), (2) The Bunsen Peak Road (5.88 miles), (3) The Firehole Canyon Drive (2.20 miles), (4) The Virginia Cascade Drive (1.94 miles), (5) The Mount Washburn Road (1.45 miles), (6) The Blacktail Deer Plateau Road (6.88 miles), and (7) The Madison River Loop Drive (1.10 miles). A determination of eligibility will be done on the Gallatin Highway (20.50 miles).

The ethnographic record for the park is incomplete. Little is known about native American use or perception of Yellowstone's resources. As ethnographic studies are completed a more thorough understanding of Yellowstone's cultural resources will be possible and ethnographic resources will be identified.

SOCIOECONOMIC ENVIRONMENT

The size of the GYA and the number of involved government entities at the federal, state, and locals level combine to create a complex socioeconomic environment. Politically the GYA extends across portions of 17 counties located in three states. The GYA contains Yellowstone National Park, John D. Rockefeller, Jr. Memorial Parkway, and Grand Teton National Park. Also included are seven national forests — Gallatin, Custer, Shoshone, Bridger-Teton, Targhee, Beaverhead, and Caribou. Two units of the national wildlife refuge system, National Elk Refuge and Red Rocks National Wildlife Refuge, complete the federal landholdings in the GYA. State and private lands are also included within the area.

Yellowstone National Park plays a prominent social and economic role in the GYA. Gateway communities of varying sizes have developed outside of the five entrances. They are Cody, Dubois, and Jackson in Wyoming and Cooke City, Silvergate, Gardiner, and West Yellowstone in Montana. The Montana gateway communities are on the immediate border of the park or within a few miles of the park; the Wyoming gateway communities are an hour's drive or more from the park boundaries. These communities provide food, lodging, gasoline and other automotive supplies and services, souvenirs, and other goods and services to the motoring public. The availability of services varies from gateway community to gateway community. Quantity and quality of services are somewhat dependent upon the size of the community and the volume of traffic passing through the towns. The gateway communities are relatively small. Their populations range from less than 150 permanent residents for Cooke City and Silvergate combined, to about 8,000 for Cody. The link to tourism is evident. Relatively large numbers of motels, restaurants and souvenir shops are located in the gateway towns. The economic viability of gateway communities is heavily dependent upon the recreation and tourism traffic that is generated by Yellowstone and other public recreation resources. Throughout the GYA, public lands provide the basis for much of the economic activity (recreation, mining, forestry, and agriculture) that occurs within the region. Within the GYA, recreation produces more than twice the income and about three times the number of jobs as mining, forestry, and agriculture combined.

The less than 5 percent of Yellowstone that is developed includes roads, trails, employee housing, administrative headquarters, and visitor service facilities in various areas throughout the park. Total developed area has decreased in recent years, as park managers have removed some developments from resource areas and other developments have been consolidated.

Commercial activity within the park is conducted under the auspices of the park's branch of concessions. Park employees in this branch administer three concessions contracts, one concession permit, a joint venture agreement, over five dozen limited concessions permits and numerous commercial use licenses. Economic activity is concentrated at six locations, all along the road system: Fishing Bridge, Lake Village, Bridge Bay, Canyon Village, Tower-Roosevelt, Mammoth Hot Springs, Old Faithful, West Thumb, and Grant Village. A wide range of services, including food, gas, lodging, transportation, horse rental, and medical services, are provided through concession arrangements.

The majority of the nearly 3,200 employees hired by concessioners during the summer season live in the park. These workers and almost 800 seasonal Park Service employees make up several small communities centered around the park locations mentioned above. These communities have evolved due to the demand for goods and services by the visiting public. Yellowstone is the focus of much of the economic activity in the GYA due to the large volume of visitation that the park receives.

Park visitation and the economic activities that support it are highly seasonal. June, July, and August are the months of highest visitation. The "shoulder seasons," the periods before and after the peak season, have experienced a gradual increase in use over the past two decades. The volume of visitation during the shoulder season months of May and September, although less than the summer season, is significant. Additionally, there has been a dramatic growth in winter use of Yellowstone.

In 1991 the park received in excess of 2.9 million recreational visits. About one million vehicles used the road system. The west entrance accounted for over one-third of the vehicle entrances and the south entrance provided access for more than one-quarter of the total. The northeast entrance was the least utilized, and provided for little more than one-twentieth of the total traffic entering the park. The remainder was split almost equally between the north and east entrances.

Visitation in 1991 reached a record high. Annual visitation to Yellowstone has been variable. In 1988 it was down because of forest fires in the park. Visitation has since rebounded. The general trend over the years has been for visitation to increase, and that trend is expected to continue. Soon recreational visits are expected to exceed 3 million per year. More than 1 million vehicles already use the road system during the six months the roads are open to vehicle use.

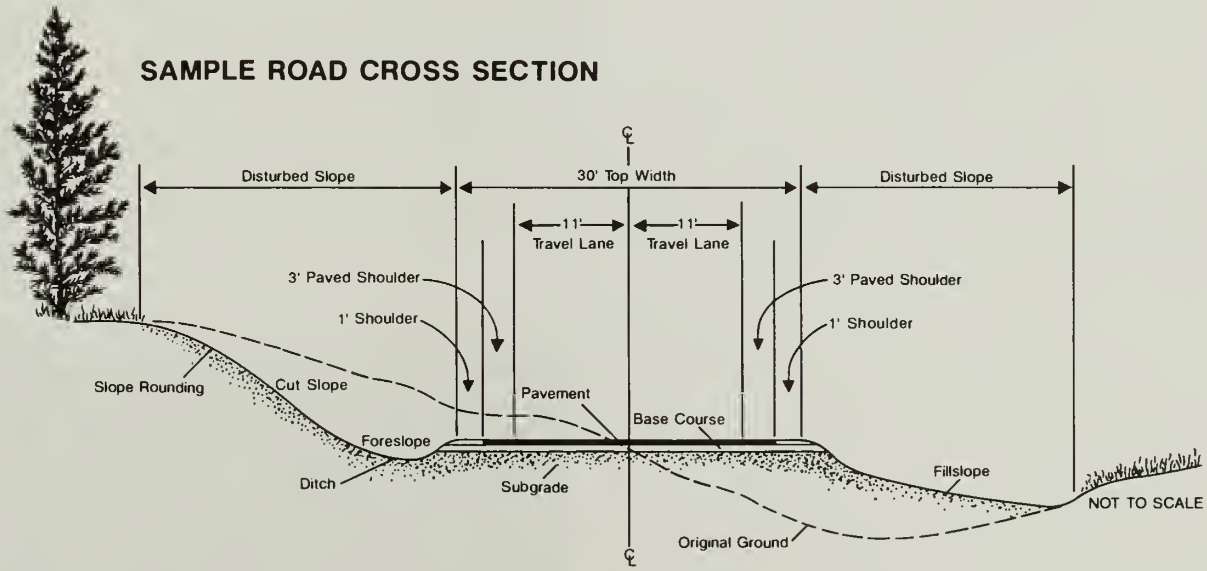
Economic activity and visitor use in Yellowstone are dependent on the principal park road system. The seasonal nature of park use is dictated by climate and local weather patterns. During the winter season snow blankets most of the road system. Park roads are closed from approximately November 1 to April 30. When covered by snow, the road system is available for snow coach, snowmobile, and crosscountry ski use. The only exception is the road that connects Gardiner, Montana, and Cooke City, Montana. This section is plowed and kept open as the only winter road link available for the towns of Cooke City and Silvergate. Limited use of the park during the winter season is becoming more important for some gateway communities, especially West Yellowstone, but in 1990 winter use amounted to only about one-twentieth of the total visitation to the park.

Almost 350 miles of park roads are open to the public. The roads accommodate various types of vehicles. Everything from bicycles to commercial tour buses use the roads. Commercial truck traffic is prohibited, but some large trucks must pass through the park to provide the goods and services needed by the visiting public. Great stress is placed on some segments of the road system by tour buses. A fully loaded tour bus can weigh more than a loaded logging truck.

PROPOSED PARKWIDE ROAD IMPROVEMENT PLAN

COMBINED PROGRAM OF 3R AND MR PROJECTS

The proposed plan calls for a long-term schedule of combined road improvement project types as determined by the FHWA in cooperation with the Park Service (see Proposed Road Improvement Program map). The *Parkwide Road Engineering Study* (FHWA 1986) provided the basis for formulation of the long-range road improvement program. According to the study's evaluation of principal park roads that exhibit critical functional, structural, or capacity deficiencies, the MR program has been prioritized and integrated with a 3R program. This long-range program is based on eventual reconstruction of most roads, including those treated with 3R. The assigned priority number indicates the order in which both 3R and MR projects would be funded and completed; project start dates and the duration of individual projects would depend on FLHP funding and construction conditions such as weather, existing physical roadway conditions, resource issues, and traffic management. Project priority could change due to future road conditions or funding. The compliance required for each route-specific project is tentatively identified. At this time, no construction of new roads or major realignment of existing roads are planned; however, geotechnical data is still being gathered between Gardiner and Mammoth that could influence final decisions on the road realignment of this segment. Generally, no more than two major projects would be operating concurrently; however, this would be dependent on the availability of funding. The NPS 1984 *Park Road Standards* provide guidelines adaptable to a park's unique character and resource limitations, and provide the framework within which design and construction of park roads is conducted. Park road design elements include proper roadway width, which could be influenced by numerous factors, including park resource considerations, existing and/or planned volumes and types of traffic, safety, terrain, and design speed. A sample road cross section is illustrated below.



SAMPLE ROAD CROSS SECTION

In addition to adding a margin of safety for motor vehicles, widening of road shoulders would also provide reasonable separation of bicycles from motor vehicle traffic. Although separate bikeways are normally the safest alternative, they would be impracticable because existing road corridors are too narrow and surrounded by sensitive natural and cultural resources.

Most roads would be scheduled for reconstruction while other roads would be maintained at acceptable short-term operational levels by 3R projects. This systemwide approach of reconstructing roads with the most critical need while rehabilitating other road segments for eventual reconstruction would allow continued visitor use of the entire principal park road system.

Road rehabilitation of the 3R type typically entails a pavement overlay of an existing road, minimum excavation, replacement of inferior base material, and case-by-case realignment of dangerous curves and intersections. There would be some disturbance of cut/fill slopes for unsuitable base material excavations (dig-outs), but there would be less impact than with MR. On 3R projects, the FHWA standards applicable to MR would in some instances not be attainable.

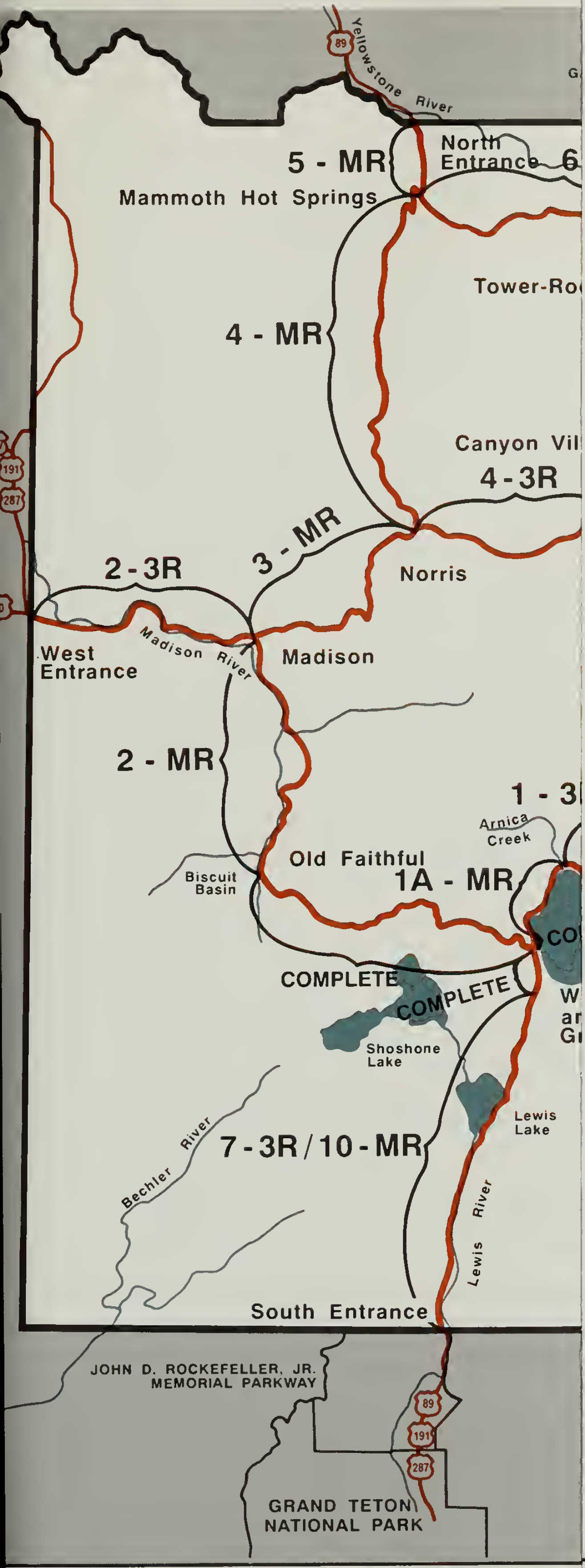
MR projects on principal park roads generally include minor realignment, replacement of base material, shoulder reinforcement, and widening of the existing roadbed. Earlier meetings between the NPS and FHWA resulted in a preferred road top width of 30 feet where feasible due to significant resource impacts. The recently completed MR of the road segment from Old Faithful over Craig Pass to West Thumb provided the 30-foot top width (11-foot travel lanes, 3-foot paved shoulders, and 1-foot shoulders).

Some housing for construction employees might be provided in existing facilities at developed areas in the park; however, the remainder of personnel required for road improvement projects would probably reside outside the park.

MITIGATING MEASURES

Road Design/Construction

Whenever possible, road base widening would be confined to one side with the center line shifted accordingly to avoid important historic or natural features, or large cut and fill slopes along the roadside. Center line shifts would be dependent on existing geometry and would comply with standard safety design principles.



PROPOSED ROAD IMPROVEMENT PROGRAM

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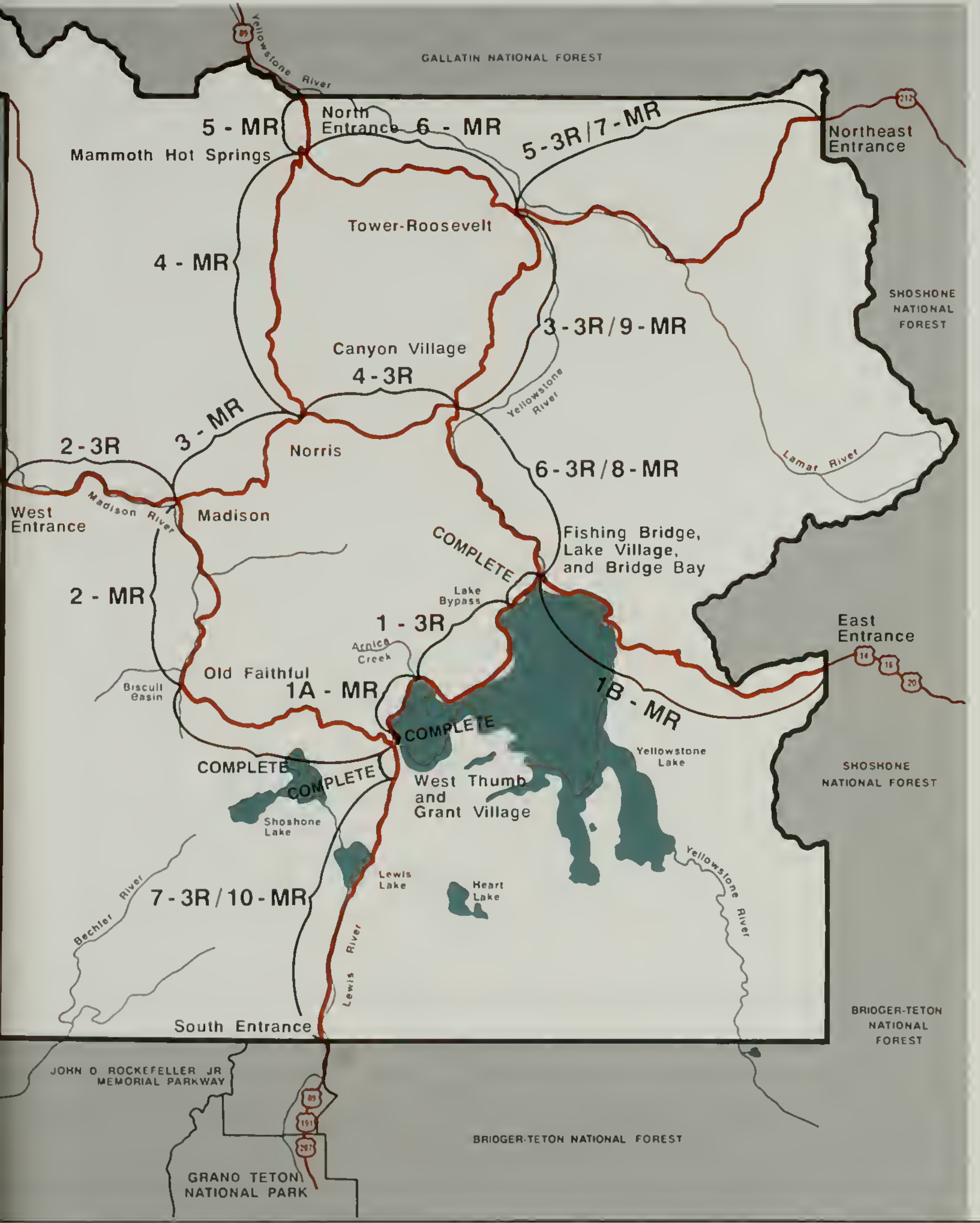


3R - RESURFACING, RESTORATION, AND REHABILITATION

PRIORITY	MILES
1 - Lake Bypass S to Arnica Creek (CX)	3.28
2 - Madison to W Entrance (CX)	13.86
3 - Canyon Village to Tower-Roosevelt (EA)	18.23
4 - Norris to Canyon Village (CX)	11.57
5 - Tower-Roosevelt to NE Entrance (EA)	29.15
6 - Fishing Bridge to Canyon Village (EA)	14.99
7 - S Entrance to Grant Village (CX)	21.45

(CX) - Categorical Exclusion
(EA) - Environmental Assessment Will Be Prepared

MR - MAJOR RECONSTRUCTION

PRIORITY	MILES
1A - Arnica Creek to W Thumb (EA)	3.20
1B - Fishing Bridge to E Entrance (EA)	26.02
2 - Madison to Biscuit Basin (EA)	13.81
3 - Norris to Madison (EA)	13.88
4 - Mammoth Hot Springs to Norris (EA)	20.24
5 - N Entrance to Mammoth Hot Springs (EA)/(EIS)	5.23
6 - Tower-Roosevelt to Mammoth Hot Springs (EA)	18.20
7 - Tower-Roosevelt to NE Entrance (EA)	29.15
8 - Fishing Bridge to Canyon Village (EA)	14.99
9 - Canyon Village to Tower-Roosevelt (EA)	18.23
10 - S Entrance to Grant Village (EA)	21.45

(CX) - Categorical Exclusion
(EA) - Environmental Assessment Will Be Prepared
(EIS) - Environmental Impact Statement May Be Required If Road Realignment Is Considered

PROPOSED ROAD IMPROVEMENT PROGRAM

YELLOWSTONE NATIONAL PARK

UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE
OSC / FEB '92 / 101 / 40261A

Natural Resources

1. Roadbanks and disturbed soil areas would be revegetated by conserving existing topsoil (see appendix C).

2. Several mitigation techniques could be used to reduce wetland impacts, including shifting the road alignment, using retaining walls at roadsides, reducing road width through wetlands, and elevating the roadway on piers/pylons.

3. Several techniques can be used to mitigate the loss of wetlands: reclaim previously filled-in wetlands, create new wetlands, and/or create or restore wetlands in appropriate material sites after material extraction.

4. Drainage cross-sections would be maintained or enlarged in order not to impact floodplains. Retaining walls would also be used in drainages to reduce amount of fill in floodplains.

5. Spills from construction equipment would be reduced or prevented from entering waterways through use of barriers in gullies, ditches, and low drainage areas. Possible rockfall hazards would be reduced by the use of intercepting slope ditches and shaped berms.

6. Stabilized turf shoulder material would be considered that uses salvaged topsoil or subsoil from within the road corridor mixed with processed aggregates.

7. Salvaged topsoil would be conserved and replaced in a manner similar to its original condition as soon as possible.

8. Sediment traps and barriers would be used to avoid excessive sedimentation in streams. Adequate cross-drains would be developed to ensure proper drainage.

9. Thermal areas within the roadway prism would be accommodated or avoided by road design where possible.

10. New vehicle pullouts would be planned and located to recognize sensitive wildlife habitat.

11. Work activities would be scheduled to accommodate critical periods of wildlife use within the road corridor. Important habitat features would be conserved or enhanced where possible.

12. Techniques and procedures to mitigate possible impacts on threatened and endangered species would be developed on a segment-by-segment basis in consultation with the Fish and Wildlife Service, and followed during construction activities. Similar measures would be used to avoid impacting state-listed species and species of special

concern. Avoidance and protection also would be provided for any identified sites of federal candidate plant species.

13. Construction workers and supervisors would be trained in regard to the special sensitivity of park values, regulations, and appropriate housekeeping and behavior in grizzly habitat.

Cultural Resources

Archeological sites would be avoided wherever possible by road alignment shifts away from the sites. Where this is not possible, some form of mitigation would take place, to be determined on a case-by-case basis. Archeological surveys would be conducted for each segment of the road system before construction takes place. This precedent would continue for all future road segment projects.

If archeological resources prove impossible to avoid, one or more of the following mitigative strategies would be used:

1. Inventory, collect, and excavate artifacts (sites).
2. Test to determine the significance of a buried site.
3. Map and record sites to be buried.
4. Monitor high probability site locations during construction.

The historic values inherent in the road system would be preserved and any adverse effects upon this historic landscape would be mitigated. The use of the road as a transportation corridor has remained the same; however, a historic landscape is not static, but always changing to meet the needs of visitors, to improve with advancing technology, and to meet weather, natural and geologic concerns. The historic landscape seen today does not exist exactly as it was first constructed. Many of the road alignments, width of roads, surfacing material, guardwalls and guardrails, culverts, and traffic patterns have changed or been altered many times. Despite the fact that the road has had many changes and certainly does not look as it did during the historic period, it is the continuation of the National Park Service design philosophy of harmonizing man-made features with the environment that is important. It is not the road alignment, width of the road, surfacing material or traffic patterns that are significant, but the historic configuration and the historic landscape as it has evolved. The thrust of this plan, therefore, must be to harmonize these man-made features with the natural environment. Designed features such as log guard railings, stone masonry guard railings, designed pullouts with landscaping features, curbing, and embankments are considered features of the road. The National Register process should be completed by the summer of 1992, and the historic resources formally and officially identified.

In conjunction with the nomination effort, during the summer of 1989, a HAER team recorded the historic bridges and some road sections in the park. All of the historic bridges were photographed to HAER standards and measured drawings were completed for seven of the bridges: Cub Creek, Crawfish Creek, Fishing Bridge, one of the Gibbon River bridges, the Army bridge at the end of the Fountain Freight Road, the Army bridge over Obsidian Creek, and the Gardner River bridge east of Mammoth Hot Springs. If any bridge is to be removed as a result of this plan, the HAER documentation, including the report, has already been completed as a mitigative measure. It should be noted that nearly all of the wooden guardrail is modern and much of the stone guardrail has had some reconstruction or complete reconstruction over the last 110 years. In future route-specific environmental documents, historic features will be indicated on a detailed mapping series provided by FHWA.

The widening of any segment of principal park roads could have an effect on historic resources such as bridges, culverts, masonry retaining walls, embankments, and other historic features close to the road. Effects on any historic features caused by widening could be mitigated, for example, by disassembling masonry portions and reassembling them in the same configuration at their new location. Any new construction or reconstruction should follow the design philosophy of man-made features harmonizing with nature.

All construction employees would receive instruction in regard to the special sensitivity of cultural resources and actions appropriate when cultural resources are encountered.

Two to six months before road construction, personnel from the Cascades Volcano Observatory would measure and place offset marks away from the road but near existing geological benchmarks. After construction, the benchmarks would be relocated on the road by surveying from these offset marks or would be left in the new locations in case of future roadwork.

Socioeconomic Environment

One or more of the following mitigation measures would be employed as necessary and practicable.

1. Work usually would be done on two to three segments of the road system at a time. Scheduling of projects and day-to-day work would strive to minimize impacts on visitors, concessioners, gateway communities, etc. These projects would normally be at opposite sides of the park.

2. Contractual stipulations would be written and enforced regarding beginning and ending dates for construction, hours of work, provision for traffic flows, duration of traffic stoppages, etc.

3. The complete closure of specific routes would be limited to off-season periods and nights unless compelling circumstances warranted otherwise. Daytime traffic flows would be maintained with as little delay as practicable.

4. Visitors, concessioners, gateway community members, park staff, employees of other agencies, and others would be informed and consulted as to means to minimize impacts regarding road improvement projects and the progress being made. A public information program to explain the necessity for road closures, traffic stoppages, etc., would describe

the hazards and costs of a deteriorating road system and the benefits of the improvement. An effort would be made to minimize the negative economic impacts to concessioners, members of gateway communities, and others .

5. Coordination with other federal, state, and local agencies regarding the road improvement program would be ongoing.

6. Project-specific mitigation measures would be developed as necessary.

7. Traffic management plans would be developed for individual road projects to mitigate the disruption to the visitors while allowing for efficient and economical work on the road.

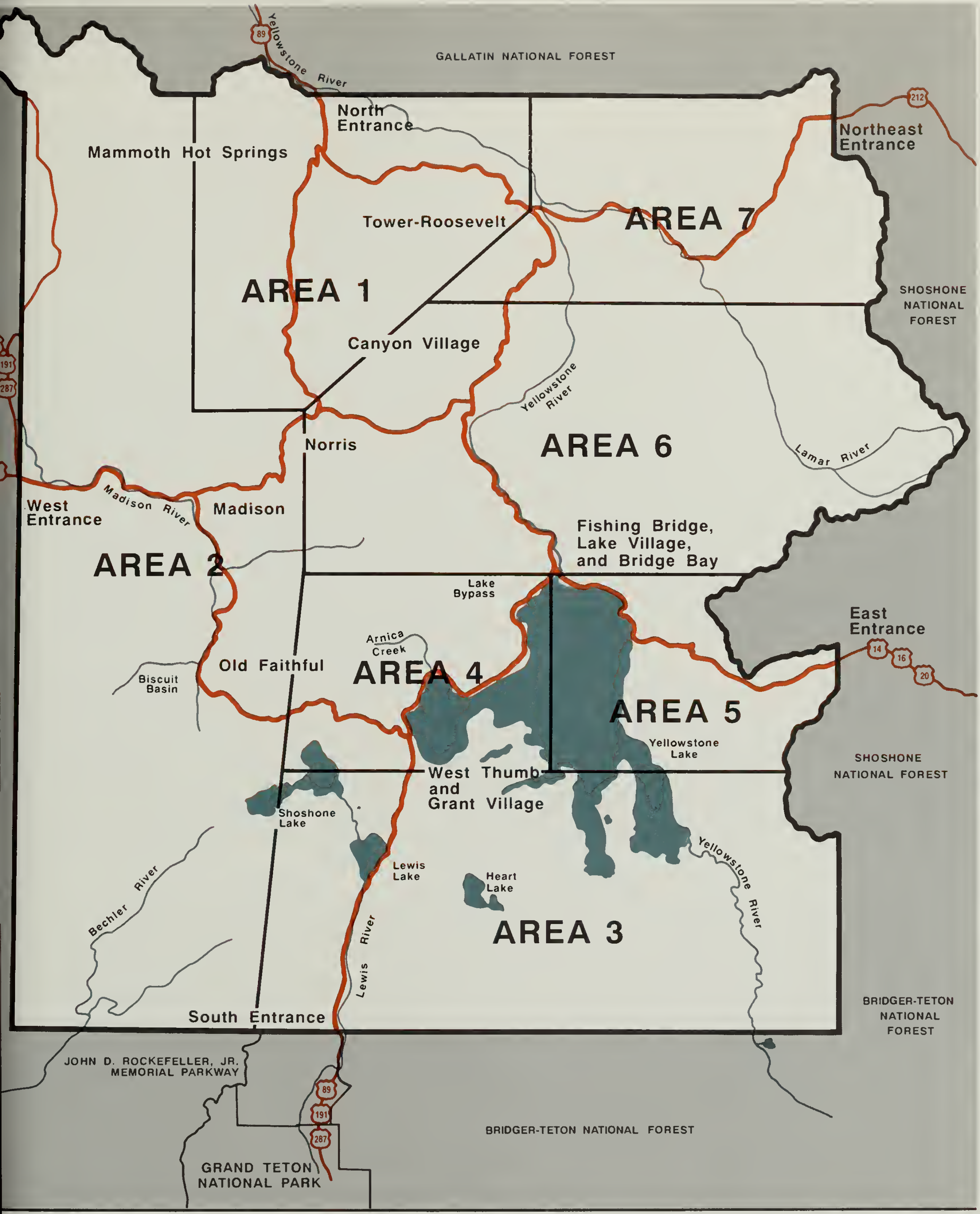
8. The impacts of accommodating construction personnel within the park, including providing for housing, utilities, and other services, would be minimized; mitigating measures regarding temporary accommodations for construction employees would include, but not be limited to, concentrating their living facilities within currently developed areas of the park or busing them from outside the park to the construction site(s).

9. Road design would emphasize visual quality while minimizing impacts to resources.

ROAD MATERIAL SOURCES

The proposed plan would use material sources needed for road reconstruction, rehabilitation, and maintenance projects. Sources of quarried stone needed to reconstruct and repair historic masonry features in Yellowstone would also be included. Material sources on public lands and from commercial suppliers would be selected on the basis of resource impact, social impact, and economic cost. The southern Yellowstone area (see Area 3, Road Material Need Areas map) would generally be supplied by material sources on public land (NPS 1991d) and the rest of the park would be supplied by purchase from commercial sources when available or from existing sources and potential sources developed on public land.

The FHWA study quantified projected road material needs for the long-term improvement plan, including estimates for common borrow, in different areas of the park. Seven "road material areas" were created to facilitate the analysis of material needs to supply road projects in each park area. FHWA material source estimates are based on the long-term need for mineral aggregate roadway surfacing and paving material, the first 10 years of which are based upon MR, 3R, and/or preventive maintenance programs (see table 1 for summary of aggregate, borrow, and waste material quantity estimates). Once this road improvement program is completed, material needs would be reduced. In addition to park road needs, mineral aggregates for other elements of the park infrastructure (parking areas, visitor use facilities, administrative facilities, building components, drainage installations, sanitary facilities, and erosion control) are included in the estimates.



ROAD MATERIAL NEED AREAS

YELLOWSTONE NATIONAL PARK

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Management flexibility would be needed for final selection of material sources and quantities of material extracted from each site for each route-specific road project. This flexibility is needed to adapt to changing resource needs/concerns, such as natural, cultural, visitor, and economic resources. Final selection might utilize few or many of the sources identified by the FHWA, with excavation quantities dependent on the number of sites. Material extracted from existing park sources would only be used for park purposes by either NPS maintenance crews or contractors, in compliance with the NPS management policy discussed earlier.

Material would be excavated, loaded, and transported to a processing plant. The excavation source and processing plant would ideally be located nearby on the same site to reduce transportation cost and improve efficiency. Processing typically consists of crushing, sorting, cleaning, and stockpiling finished aggregate material. Usable finished roadway paving and base-course aggregate material usually represents 50-60 percent of the total raw material processed, with the remainder rejected or wasted. "Waste material" is generally inferior material left over from the crushing operation, old substandard road material that is removed and replaced, and/or overburden from a material site. A portion of the remainder could be useful for purposes other than paving aggregate, such as sanding or utility line bedding material. Rejected fine material would be returned to upland sources for site restoration use if it could not be used for other maintenance or construction purposes. For pavement projects, the contractor would usually operate a hot-mix asphalt plant at the same site. Hot asphalt would then be hauled to the application point on the road job. Contractor equipment and vehicles would be stored at the site. Staging refers to general contractor activities at the site such as equipment and material storage.

Unless sites were dedicated to long-term maintenance use, material sources and staging areas on public lands would be restored after use as part of the project, with restoration costs funded as a part of road improvement costs. Restoration would consist of removing stockpiled material, regrading to blend with nearby natural landforms, removing access and associated abandoned roads where appropriate, scarifying surface soil, and distributing salvaged topsoil that was initially windrowed (see appendix C). Commercial sources must have restoration plans, and a portion of the royalty fee paid by the purchaser is set aside for eventual site restoration when operations cease.

The FHWA (1990) *Preliminary Draft Material Source Study* identified existing sites in the study area and estimated potential reserves and engineering quality of material (see appendix A). The majority of the in-park sites are old gravel pits, quarries, or other areas previously disturbed by human activities. Reclamation was minimal due to funding limitations. These sites have varying degrees of plant growth and varying needs for restoration. Some of the abandoned pit sites in the park have been adapted to secondary uses such as administrative or maintenance operations areas, material or equipment storage yards, debris disposal areas, etc. Some sites have been partially or totally reclaimed and blend into adjacent natural resources; however, most show landscape scars that, while hidden from public view, intrude upon and detract from park natural resources. Restoration costs can now be funded with a road improvement project if the site supplies or supports the project. Sources of restoration funding have been very limited in the past. There is potential for developing existing sites inside the park for limited-term material extraction under a preplanned program of reclamation and revegetation with site restoration accomplished at the end of the project. Service roads to the existing material sites might require grading or other minor preparation and upgrading to allow heavy equipment access to sites.

Eleven general areas or specific sites containing reserves of raw mineral aggregate material also were identified on private or public lands outside park boundaries (FHWA 1990). Some of these sites or areas are located up to 20 miles from the park. Efforts were made by FHWA to locate all known previously worked sources of roadway surfacing material outside the park and to evaluate each site for adequate quality and quantity of estimated reserves. Additionally, sufficient exploratory work was conducted in road-accessible areas to ascertain the existence of suitable new raw material sources. The FHWA did not consider potential source areas more than 20 miles away due to long haul distances, steep grades, and resultant high transportation costs.The USFS and BLM cooperated in identifying these sources, in assessing their availability, and in determining the environmental concerns regarding their use.

Of the 213 existing and potential material sources examined by the FHWA, seven sites were strongly recommended as sources of aggregate and/or for one or more of the following uses: borrow, disposal of waste material, staging, and/or maintenance (see appendix A). The recommended sites are: Soda Butte Creek Dry Wash, Bridge Bay Quarry, Sylvan Pass Pit, Snake River Pit #2, Nez Perce Quarry, Old Fountain Trail Pit, and a commercial site in the West Yellowstone area. Following further investigation an additional seven sites were recommended as possible aggregate sources and an additional 22 sites were identified as having potential for aggregate and for one or more other uses.

Potential unspecified commercial sources could be either actual developed sites or commercial sources developed in the future, as market conditions of supply and demand provide incentives for development of private land. Development of new sources and use of existing pits on private lands outside Yellowstone would be regulated by applicable county, state, and federal permits, and permit applications would be the responsibility of the developer and are beyond the scope of this document. The National Park Service is required to comply with section 106 of the National Historic Preservation Act for material sources on private land if cultural resources could be affected.

Special Directive 91-6, on the administrative use of in-park borrow material (see Appendix B), provides direction on interpreting and applying the 1988 NPS *Management Policies* related to NPS use of borrow pits and spoil areas (Chapter 9, page 4). A written analysis addressing questions in this directive would be included in environmental documents for future route-specific road projects to assess impacts of proposed road improvement and the use of specific material sources. These questions would apply to material sites in the park and to new and existing sites on public lands outside the park proposed for use on a particular road project. A more general written reply has been included in Appendix B for the parkwide plan.

MITIGATING MEASURES

Natural Resources

1. Following excavation of material, sites would be recontoured to blend with surroundings and revegetated by conserving existing topsoil (see appendix C).

2. Salvaged topsoil would be conserved and replaced as soon as possible.

3. Work activities would be assessed to minimize the impact on critical periods of wildlife use within and adjacent to material sites. Important habitat features would be conserved or enhanced where possible.

4. Techniques and procedures to mitigate possible impacts to threatened and endangered species would be developed on a segment-by-segment basis in consultation with the Fish and Wildlife Service and followed during extraction activities. Similar measures would be used to avoid impacting state-listed species and species of special concern.

Cultural Resources

Archeological surveys would be considered for road material sources on public or private lands chosen for use in road reconstruction or rehabilitation and these locations would receive clearance in accordance with Section 106 of the Historic Preservation Act of 1966 as amended. If significant archeological materials are discovered in conjunction with these sites, they would either be avoided or mitigated by the strategies listed above under the "Proposed Plan for Road Improvement."

If a material source on public or private land is identified as being a historic resource or is immediately adjacent to a historic district, the site would either be avoided or clearance in accordance with Section 106 of the Historic Preservation Act of 1966 as amended would be completed.

Socioeconomic Environment

Mitigating measures would include those stated in the "Proposed Plan for Road Improvement" as well as the following:

1. Road material extraction sites would be utilized in a manner that would not severely impact visitors' recreational experiences, nor imperil visitor safety.

2. Usable sites generally would be visually unobtrusive, taking advantage of natural and man-made screening.

ALTERNATIVES TO THE PROPOSED PLAN FOR ROAD IMPROVEMENT

ALTERNATIVE A: NO ACTION

Existing park road maintenance activities would continue. Annual road maintenance performed by park road crews depends on the condition of individual road segments, and would include chip/seal application, pothole patching, and minor shoulder reinforcement. Aggregate material for these operations would be purchased from existing commercial sources and would be a small fraction of the aggregate needed for the overall road improvement program. Improvement projects that require large quantities of aggregate material, such as asphalt pavement overlays, would be deferred indefinitely, resulting in road closures.

ALTERNATIVE B: 3R ONLY

This alternative calls for a schedule of no construction over and above a 3R treatment with minimal widening. It is assumed that while pavement widths would be slightly less than for alternative C – MR only, there would be an offsetting need for more intensive road maintenance; consequently, more material would be required and the cost could almost equal that for MR only. Major reconstruction projects needed on some road segments would be deferred indefinitely, potentially resulting in road closures. Road maintenance and sanding requirements would be similar to those described in the proposed plan.

This type of road improvement typically includes a pavement overlay of an existing-width road, minimum excavation and replacement of inferior base material, case-by-case realignment of dangerous curves, modification of turnouts and intersections with safety problems, and possible installation of guardrails at dangerous areas. There could be some disturbance of cut/fill slopes for unsuitable base material excavations (dig-outs), but less impact than with MR. On 3R projects, the FHWA standards applicable to MR would in some instances not be attainable.

Mitigating Measures

Natural Resources. Mitigation measures would be similar to those described in the "Proposed Plan for Road Improvement."

Cultural Resources. Since the 3R approach to road repair in Yellowstone would entail minimal widening of the roadbed and thus less moving of historic bridges and other features, the impacts would be less than those described in the proposed plan. Mitigation strategies would include:

1. Avoidance of cultural resources wherever possible.

2. Mitigation of unavoidable adverse effects by use of the detailed strategies stated above in the "Proposed Plan for Road Improvement," including clearance in accordance with Section 106 of the Historic Preservation Act of 1966 as amended.

Socioeconomic Environment. The same mitigating measures as described for the proposed plan would be required.

ALTERNATIVE C: MR ONLY

In this alternative, the emphasis would be on major reconstruction of most principal park roads. Without integration of a 3R program, some road segments would potentially be closed to visitors because they would disintegrate before being scheduled for major reconstruction. After all major reconstruction work is completed, road maintenance and 3R treatment of some road segments would follow as needed.

MR projects generally include minor realignment, replacement of base material, shoulder reinforcement, and widening of the existing roadbed. Overall, pavements widths would be wider and material needs greater than in the 3R-only alternative. The recently completed major reconstruction of the road from Old Faithful over Craig Pass to West Thumb provided the preferred 30-foot top width consisting of 11-foot travel lanes, 3-foot paved shoulders, and 1-foot shoulders.

Mitigating Measures

Natural Resources. Mitigation techniques would be similar to those described in the proposed plan.

Cultural Resources. The same mitigation techniques would be used as described in the proposed plan.

Socioeconomic Environment. Mitigating measures as described in the "Proposed Plan for Road Improvement" would be implemented.

ALTERNATIVES TO THE PROPOSED PLAN FOR ROAD MATERIAL SOURCES

ALTERNATIVE AA: NO ACTION

Under this alternative, existing park road maintenance activities would continue, but with no development of new material sources or excavation from existing inactive material sources inside or outside of the park on public lands. Aggregate material for maintenance operations would be purchased from existing commercial sources. Estimated long-term needs for maintenance material (chips, sand, and limited gravel) required for alternative A, the no action alternative for road improvement, are presented with material quantities for the other alternatives in table 1, following the description of the alternatives to the plan.

Continued long-term bridge maintenance would require periodic removal of stream sediment deposits in bridge openings. The material would then be disposed of at upland sites.

ALTERNATIVE BB: SOURCES FROM OUTSIDE OF THE PARK ONLY

This alternative would utilize only material sources outside the park to supply the long-term needs of road improvement. Sources would be selected from technically and environmentally feasible sites (meeting engineering standards) outside of the park, similar to those described in the proposed plan.

ALTERNATIVES CONSIDERED BUT REJECTED

PAVEMENT OVERLAY ONLY

A simple pavement overlay alternative for road improvement was considered but rejected because most of the existing road base is in such poor condition that the reconditioned asphalt surface would break up within an estimated five years or less. There are numerous existing pavement break-ups due to inadequate roadside ditches and culverts to drain water, and inferior base material that retains water. Additionally, the old road was constructed through wet areas where adequate base material to raise the road above the water table was not used.

SOURCES FROM INSIDE THE PARK ONLY

An alternative using only material sources from within the park was considered. The FHWA (1990) estimated that approximately 1.4 million cubic yards of potential raw material exist within old material source sites in the park. Additional comprehensive evaluation and testing of this material, as well as the approval of environmental documents and operating and reclamation plans, would be necessary before any of those sites could be cleared for use. Nevertheless, an estimated 80 percent of the long-term park needs for mineral aggregates in the proposed plan still would have to be obtained from sources outside of park boundaries. Since only approximately twenty percent of the total requirements for suitable aggregate, borrow, and other material could possibly be supplied by in-park sources, this alternative was determined to be infeasible. Because this alternative would totally exhaust all park road material sources without accomplishing necessary road improvement, this alternative was considered but rejected.

DEVELOPMENT OF NEW MATERIAL SITES WITHIN THE PARK

In their study, the FHWA restricted exploration in the park to those areas containing existing old material sources that are in need of reclamation, to disturbed areas where the natural resources have been intruded upon or compromised by human activities, and to areas that have previously been or would be disturbed by road improvement. This alternative was rejected because it conflicts with NPS management policy and other planning considerations presented earlier in this document.

SUMMARY OF ROAD IMPROVEMENT MATERIAL NEEDS AND COSTS

The quantities of material needed for Yellowstone road improvement have been estimated by the FHWA for the proposed plan and each alternative. Table 1 summarizes estimated quantities of aggregate, borrow, and waste material for each of the seven road material areas in the park (see Road Material Need Areas map). The needs for minor roads, parking areas, campgrounds, etc., are incorporated with those for major roads and complexes.

The quantities of common borrow and waste material that would be generated over the long term are extremely difficult to predict, since they are dependent upon the many variable design and geotechnical characteristics of individual road improvement projects, and upon resource management decisions that would be made during the design development process (FHWA 1991a). For example, even small changes in alignment or grade line can have substantial impact upon excavation and embankment quantities. Also, the physical and chemical characteristics of earthen or rock material affect their suitability as construction material. Soils incapable of supporting the roadway surfacing and pavement structure must be treated, or in some instances removed, and replaced with more competent earthen or rock material. The estimated quantities of needed material contain allowances for wasting unsuitable portions of raw material for the production of mineral aggregates.

The cost of road material is dependent on many factors. The FHWA determined the most significant factors to be the cost of material acquisition (royalty), the cost of processing and placement, and the cost of transportation. Each of these costs are variable. Royalty costs are dependent on the availability of material in a particular area, as well as on the competitive condition of the local market. Processing and placement costs include the cost of site preparation, processing plant move-in, installation, operation, maintenance, and equipment amortization. These costs vary depending upon project size, the degree of processing required, labor costs, compliance with environmental regulations, and the costs of site rehabilitation and reclamation. Transportation costs are dependent on numerous factors, including the type of equipment used, hauling distance, condition and gradient of the haul route, load weight restrictions, fuel and licensing costs, and travel time.

Consistent or homogeneous deposits of good quality raw mineral aggregates within or near Yellowstone are rare due to the particular geologic history of the area, described in the "Affected Environment" section. It is anticipated that processing costs would be high and substantial quantities of waste material would be generated in processing (FHWA 1990). A more precise determination of future quantities and sources of material and quantities and sites for future deposition of waste material would be made by the FHWA at the appropriate stage of the design development process for route-specific road improvement projects. New methods such as asphalt recycling could reduce projected aggregate needs; the following waste figures include an allowance for existing surfacing material of which a portion may be recyclable.

TABLE 1: ESTIMATED MATERIAL QUANTITIES FOR ROAD IMPROVEMENT IN YELLOWSTONE (FHWA 1991b)

ROAD MATERIAL AREA	RAW AGGREGATES AND SAND (yd^3)			
	Proposed Plan	Alternative A (No Action)	Alternative B (3R Only)	Alternative C (MR Only)
1	1,413,000	528,000	1,283,000	1,413,000
2	1,130,000	567,000	1,057,000	1,130,000
3	618,000	148,000	580,000	618,000
4	742,000	457,000	698,000	742,000
5	703,000	260,000	605,000	703,000
6	733,000	359,000	639,000	733,000
7	973,000	352,000	759,000	973,000
Subtotal	6,312,000	2,671,000	5,621,000	6,312,000

ROAD MATERIAL AREA	COMMON BORROW (yd^3)			
	Proposed Plan	Alternative A (No Action)	Alternative B (3R Only)	Alternative C (MR Only)
1	235,000	ND*	210,000	275,000
2	215,000	ND	190,000	305,000
3	105,000	ND	25,000	110,000
4	65,000	ND	50,000	110,000
5	165,000	ND	150,000	190,000
6	195,000	ND	195,000	270,000
7	240,000	ND	225,000	270,000
Subtotal	1,220,000	ND	1,045,000	1,530,000
Total Needs	7,532,000	ND	6,666,000	7,842,000

ROAD MATERIAL AREA	WASTE MATERIAL (yd^3)			
	Proposed Plan	Alternative A (No Action)	Alternative B (3R Only)	Alternative C (MR Only)
1	235,000	ND	210,000	275,000
2	215,000	ND	190,000	305,000
3	105,000	ND	25,000	110,000
4	65,000	ND	50,000	110,000
5	165,000	ND	150,000	190,000
6	195,000	ND	195,000	270,000
7	240,000	ND	225,000	270,000
Total	1,220,000	ND	1,045,000	1,530,000

*ND = not determined

PROPOSED PLAN

Impacts of Road Improvement, Combined 3R and MR Projects

Natural Resources.

Geology/Topography/Soils/Thermal Areas – Widening some road segments, creating new turnouts, and expanding intersections through a combination of MR and 3R projects would affect previously disturbed and undisturbed bedrock and soils. Some bedrock and the soil profile within the road corridor would be permanently destroyed; large cuts into the bedrock would be necessary in some places. Rockfall, a potential consequence of steep cuts, would be controlled by the creation of intercepting slope ditches and shaped berms. Bedrock material and soil would be manipulated, redistributed, compacted, and covered with impervious road material. Topsoil would be preserved and redistributed to aid in revegetation of road shoulders, cuts, and fills. Thermal features, such as small steam vents or hot spots, upon which the roadway could encroach, would be avoided by the road design if at all possible. Some travertine deposits, especially near Mammoth, might be permanently destroyed.

Slopes and soils adjacent to roadways would be disturbed. Quantities of rock and soil would be removed from the road and redeposited in embankment fill. Much of this material does not have desirable characteristics for road base course and therefore would be deposited as common borrow in areas such as deep road embankments or returned to material source sites as waste. Gross quantities are estimated for the entire park (see table 1).

Vegetation – Vegetation adjacent to roads would be disturbed; trees would be removed. Roadbanks and disturbed soil areas would be revegetated by conserving existing topsoil (see "Vegetation Management for Construction" in appendix C). There would be an increased potential for introduction of exotic plant species on road shoulders and roadbanks due to lack of competition in disturbed areas.

Wildlife – Some habitat for ground- and tree-dwelling small mammals and birds would be permanently eliminated. Following construction, reclaimed areas along the new roads should eventually be reinhabited. Some mortality of resident individuals, such as rodents, could occur during construction, although this should not negatively affect populations. Forage would be lost due to clearing of the road corridor; areas disturbed but unobstructed would eventually revegetate and be used by wildlife. Temporary displacement of wildlife and modification of wildlife use and movement within and adjacent to the road corridor could occur. Migration and use patterns would be expected to reestablish following development. Increased human presence at newly developed, properly located pullouts would probably not affect resident wildlife. Modification of certain road features could benefit some wildlife populations (e.g., replacement of culverts that currently restrict fish passage during spawning). Impacts on specific wildlife populations that might be affected by construction of particular road segments would be analyzed and discussed in greater detail in future route-specific environmental documents.

A new wider roadway might have several effects on the vehicle/wildlife accident rate. Vehicle/wildlife accidents might initially decrease due to the improved visibility afforded by the increased road width and cleared slopes. However, the vehicle/wildlife accident rate could increase after road improvement because of faster and increased traffic on the improved roads over time, and because of the increased presence of wildlife attracted by the initial growth of grass and forbs on revegetated slopes within the road corridor. Eventually, the benefits of greater sight distance could be reduced by the encroachment of trees along the road corridor. The overall, long-term effect could be to increase the vehicle/wildlife accident rate.

Threatened and Endangered Species — Threatened and endangered species, such as the grizzly bear, bald eagle, and peregrine falcon, are known to inhabit areas in and around the park road system. Without proper mitigation these species could potentially be adversely affected by road improvement work. Modification of certain road features could benefit some species. For example, the restoration of habitat by rehabilitating and revegetating old material source sites could help offset adverse effects of road widening and other development. Additional data on the specific use and habitation of particular road corridors and adjacent areas by these species would have to be collected and analyzed in future route-specific environmental documents to ascertain the complete scope of both potential adverse and beneficial impacts. Mitigation measures to avoid or reduce adverse impacts to particular species can then be developed in consultation with the Fish and Wildlife Service. Road widening and construction-related activities such as project-duration use of presently little-used material sites contributes to the cumulative effects of human activities on the grizzly bear population in the ecosystem. Once construction is completed, displacement of threatened and endangered animals is not likely to exceed existing effects from ongoing road maintenance, vehicle traffic, and concentrated visitor use. Improved road conditions and potentially higher speeds could contribute to increased wildlife roadkills, although improved visibility along the road corridor could also result from the proposed actions. These effects are best identified and analyzed in route-specific environmental documents that would be prepared. At that time, consultation with the U.S. Fish and Wildlife Service would take place and the determination of effects on threatened and endangered species would be made.

There would be no effect on federally listed threatened or endangered plants, as none are known to exist in the GYA at this time. Surveys would be conducted prior to construction of each road segment. Any federally or state-listed plants identified would be avoided if at all possible. Protection would be given to any identified sites of the two candidate species for federal listing.

Floodplains/Wetlands/Water Resources and Quality — Potential for increased water turbidity would exist during construction, particularly at stream crossings and culvert replacements. Long-term erosion would be reduced as a result of improved slopes and drainages. Drainage, streamflow, and storm runoff would be improved by larger and improved culverts. Numerous wetlands would be affected, some very small, and others extensive and bordering the existing road. Several mitigation techniques would be used to reduce wetland impacts. These include use of retaining walls at roadsides, reducing road width through wetlands, and elevating the roadway on piers/pylons. Reclamation of previously filled-in wetlands and creation of new wetlands would offset the loss of other wetlands. The amount of wetlands affected would vary considerably on different road segments; consequently, more detailed information would be presented in the route-specific environmental documents.

Where drainages are perpendicular to roadways, installation of larger culverts would improve flows in floodplains. Where drainages are parallel and adjacent to roadways, flows in floodplains could be adversely affected where roads would be widened, since the increased fill would reduce the drainage cross-section area. However, the amount of fill could be reduced through use of retaining walls.

Construction equipment could spill oil, gas, and chemical solvents into waterways. Spills would be reduced or prevented from entering waterways through use of containment devices in gullies, ditches, and low drainage areas.

Air Quality — Road construction equipment would cause temporary increases in noise, dust, and fumes during construction. Trucks hauling on service roads, main park roads, and roads outside the park would contribute to increased motor vehicle emissions.

Cultural Resources. Widening some road segments, creating new turnouts, and expanding intersections through a combination of MR and 3R projects might impact archeological sites adjacent to the widened portions of the road as well as affect bridges, culverts with masonry headwalls, retaining walls, guardrails, gutters, and other features. However, the survey and mitigating measures outlined in the plan would adequately preserve and protect the prehistoric and historic sites that could be affected by the proposed road work and material extraction.

Socioeconomic Environment. Almost the entire road system would be affected at one time or another during the time it would take to improve the road system within Yellowstone. But, since the work would be completed in stages, only specific segments would be affected at any one time. Various mitigation measures would ameliorate most negative impacts upon the public, the park, the concessioners, and other affected parties outside the park. The proposed combination of MR and 3R work should require less time than a program of MR-only work for the road.

Increased truck traffic and other disturbance would occur due to hauling commercial aggregate through local communities. There might be some potential for damage to state, county, and park roads and bridges. However, enforcement of weight limits and other federal, state, and local regulations and contractual stipulations would minimize the potential for conflicts and/or damage.

No livestock operations are allowed in the park. Commercial use of park roads is not permitted. Regulations governing the commercial use of U.S. 191 in the northwestern corner of the park are currently being developed. The impact of road improvements within the park should not affect livestock operations outside the park; however, potential material sites outside the park might be subject to grazing use. Potential conflicts would be considered on an ad hoc basis, and mitigation measures developed if warranted.

Road construction is more costly and time consuming when traffic flows are maintained. However, complete closure of park entrance roads would severely impact park visitors, gateway communities, and the park's ability to respond to emergency situations. To minimize the impacts on visitors, park operations, park concessioners, and gateway communities, construction would proceed while maintaining at least a one-way traffic flow during peak season daylight hours. The direction of flow would alternate on a regular basis. The goal would be to delay traffic at any one construction site for a maximum of 15 to 30 minutes.

Closure of specific road segments at night and during the off-season would greatly decrease the time necessary for improvement of any one road segment. Complete closure could be required for safety reasons at some sites during specific stages of improvement. Twenty-four hour closure of portions of the loop road might be acceptable if early completion of the work would offset the delays visitors would experience in having to travel the "long way" around. The issues of public health and safety and resource protection would have to be satisfied for this to be contemplated. The concerns of concessioners and gateway communities would also have to be addressed. Adequate notice of the park's construction plans should be given to visitors, concessioners, and the gateway communities so that they could plan and adjust their operations accordingly. Impacts, positive or negative, could then be mitigated if warranted.

Some inconvenience and travel delays for visitors would be unavoidable. Visitors would be exposed to the usual hazards associated with highway construction as well as the associated noise and visual impacts. These situations could be mitigated by keeping the public well informed regarding the current construction and traffic situation within the park. Opportunities for interpretation near construction sites could be utilized to enlist the cooperation and support of an understanding public.

Housing construction personnel within the park would increase the impact on housing and support services. These impacts would be minimized by utilizing existing developed areas and other resources to the fullest extent practicable. The needs of construction personnel would be met without development of additional housing or other facilities.

Short-term benefits would include economic gains for road contractors, their employees, and material suppliers. The nearby gateway communities would benefit from the increased demand for goods and services by the workers and their families. Some local residents could find employment due to the construction activities.

Short-term costs to visitors and others would be more than offset by long-term gains. Improved safety conditions for motorists and bicyclists would be readily apparent. Improved driving comfort and safety would provide visitors with a less stressful and more enjoyable experience. A wider road and paved shoulders would provide a margin of safety for both motorists and bicyclists. Injuries could be prevented and property as well as lives saved. In addition, road maintenance costs would be lower for reconstructed roads than they currently are for deteriorating roads. The portions of the road system that receive 3R treatment would also be substantially improved.

Cumulative Effects. Under the proposed plan, a limited number of principal park road segments would be improved simultaneously and the work would be coordinated with adjacent road improvement outside the park. Over 20+ years, the entire road system would be improved if funding is available. Affected socioeconomic entities should have time to adapt to the changing situations. If visitors, concessioners, and the gateway communities are given adequate notice of the park's construction plans, they will be able to plan and adjust their operations accordingly. Cumulative effects, or the sum of the incremental impacts, to cultural, natural, and socioeconomic resources (positive or negative) could then be mitigated if warranted. Since the work would be completed in stages, only specific segments would be affected at any one time. This would help to lessen the extent of cumulative impacts.

Circulation throughout the park, road safety standards, driving comfort, and the visual quality of the road corridor would be improved. These beneficial changes could result in increased visitation and more traffic. The park accident rate might also change. The higher safety standards of the road and improved sight distance could decrease vehicle accidents. However, improved road conditions could also encourage travelers to drive faster than posted speeds, possibly resulting in an increased accident rate.

The effects of cumulative impacts on visitors, park operations, gateway communities, and concessioner businesses due to successive road segments being improved is not totally predictable. Road maintenance and resurfacing work are ongoing aspects of park operations, and have not had a significant impact. Negative impacts of the proposed plan should be short lived. The positive impacts of an improved road system, cumulative and otherwise, would be long term.

Cumulative impacts on visitor experiences due to successive road improvement projects would not be all negative. Since the visitor would be likely to encounter a project in only two or three segments of road within the park during any one visit, cumulative negative impacts should not be too great. Understanding the reasons for the inconvenience would ameliorate most negative experiences a visitor might have. Repeat visitors would become accustomed to the construction scenario, and would also benefit from the improved road system.

Because the existing transportation system and travel methods would be perpetuated, impacts associated with the original development of the roadway (such as habitat loss and fragmentation, and modification of wildlife use and movement) would continue. There are no new impacts foreseen; however, vehicle/wildlife accidents could increase, and an increase in bear deaths is possible. The loss of one to two female grizzly bears per year could result in a downward trend for the population. This potential vehicle/wildlife accident rate increase is not expected to affect the populations of other species, but it could result in the death of more individuals.

In 1984 the Yellowstone Ecosystem Management Subcommittee of the Interagency Grizzly Bear Committee (IGBC) adopted an objective of developing a methodology to quantitatively and qualitatively assess the cumulative effects of human activity on the grizzly bear and its habitat in the Yellowstone ecosystem. Subsequently, the USFS and the NPS jointly developed a computerized mathematical model called the cumulative effects model (CEM). The model was applied in the 1987 *Draft Environmental Impact Statement/ Development Concept Plan* for the Fishing Bridge developed area. Since then the IGBC subcommittee and the CEM modeling team have recognized that to make the model more usable, technological advances in computer application and data base updates must be incorporated to take into account the effects of the 1988 fires. Updated scientific information, such as that related to bear use of spawning streams, also must be incorporated into the cumulative effects analysis. At this time, the cumulative effects model is not available to effectively assess the relative merits of the alternatives in this plan (NPS 1991j).

It is not just the physical features of the roadways that make them historically significant. More importantly, the retention of the basic purpose and sensitive design philosophy of the earliest engineers help make the roadways eligible for the national register. Despite past changes in road alignments and the use of modern building materials in bridges and other road features, the basic purpose and sensitive design philosophy have been preserved.

Cumulative impacts of the proposed plan on the roadways are not be expected to be adverse. Care would be taken to preserve these special qualities, and principal park roads would not necessarily be similar in design and function with roads outside the park. For example, the designs would ensure that road modifications would not encourage an undesirable volume of traffic or high speed driving; designs would help provide a pleasant aesthetic experience for visitors; and new structures would be compatible with other historic features of the road system. Additionally, potential threats to archeological resources from heavy visitation would be reduced through thoughtful road design.

Several mineral/resource development activities are currently taking place outside of park boundaries including the Mineral Hill Mine and Jardine Joint Venture (3 miles north of the park), New World Mine Project (3 miles northeast of the park), and the McLaren Mine tailings dump (5 miles northeast of the park). A mining consortium also is currently extracting and milling minerals northeast of the park near Nye, Montana. Park staff are informed and involved to varying degrees with each of these projects.

Oil and gas leases exist outside the park boundaries, but at this time no wells are in production. The only known potential oil or gas exploration near Yellowstone is the proposed Ruby exploratory oil/gas well south of Red Lodge, Montana (33 miles east of the park), and the park is monitoring the situation. As with geothermal interests, oil and gas leases have been denied due to the proximity of the geothermal areas.

The Island Park Geothermal Area is a 488,031-acre area adjacent to Yellowstone's southwestern corner and shares a border of approximately 40 miles. The area is comprised primarily of Targhee and Gallatin national forest land, and includes state- and privately owned lands. The Island Park area has been considered for potential geothermal energy development. An *Environmental Impact Statement and Record of Decision*, dated January 1980, was prepared by the USFS. It states that certain portions of the geothermal area would be open to exploration only if there would be no adverse effect on Yellowstone's thermal features; this has not been determined and no leases are pending. In addition, the Forest Service has recommended to the BLM that exploration and development applications be withdrawn.

The Royal Teton Ranch is directly north of the park on the west side of the river near Gardiner, Montana. This ranch is within traditional wintering grounds for several large mammals, including bison and elk, and is within important habitat for the grizzly bear. Ranch activities that could affect grizzly bears and other wildlife include: planting fruit orchards and crops that attract wildlife, erecting fences that restrict and impede the movements of animals, and pasturing of domestic sheep in close proximity to native bighorn sheep, which exposes native bighorns to diseases readily transmitted from domestic sheep.

The ranch also has water rights to geothermal flows in the Corwin Springs, Montana, area (about 7 miles from the park boundary), and would like to develop these rights. A moratorium on development of federal geothermal resources in the area was placed by Congress while the U.S. Geological Survey and National Park Service prepared studies on potential connections of this geothermal aquifer with park geothermal resources. The report was presented to Congress in the summer of 1991 and stated that geothermal development could take place with limited risk of impact to Yellowstone. In September 1991, Representative Pat Williams introduced a bill that would prohibit any federal geothermal resource development within 15 miles of Yellowstone. That bill (HR3359, Old Faithful Protection Act) was passed in the House on November 25, 1991, and was referred to the Senate.

Activities in national forests have been occurring adjacent to park boundaries for many years and will continue into the future without major changes. Occasionally conflicts arise between the preservation of natural resources of the park and the activities of other agencies or groups. However, the Greater Yellowstone Coordinating Committee, a group comprised of NPS and USFS personnel, attempts to minimize conflicts and impacts and maintain a healthy, functioning ecosystem through planning, research, education, and cooperation. No major change in land use of the GYA is anticipated.

In conclusion, various mitigation measures would be used as needed to ameliorate most negative cumulative impacts of the proposed plan for road improvement on the public, the park, the concessioners, and other affected parties outside the park. A monitoring system would be considered on specific projects to determine the effectiveness of mitigation measures developed for route-specific projects. Completion of the principal park road improvements would perpetuate the existing use patterns and the positive and negative impacts on natural, cultural, and socioeconomic resources. The proposed plan is not likely to contribute to any foreseeable significant cumulative effects; however, further information is needed on wildlife use of road corridors in order to effectively assess and mitigate the effects of road improvement and traffic.

Impacts of Road Material Sources, In-park and Out-of-park Sources

Natural Resources.

Geology/Topography/Soils/Thermal Areas – Potential material source areas in the park have been previously disturbed. Partial reclamation has taken place at some. Bedrock and geological deposits could be destroyed or removed during material extraction. The soil profile overlying the bedrock also could be altered with potential for soil loss. Surface soil would be salvaged and stockpiled for restoration use. Nearby thermal features would be avoided. Reclamation following extraction would result in restoration and revegetation of the sites.

Vegetation – Vegetation covering material source sites would be disturbed. Following excavation of material, sites would be revegetated using salvaged existing topsoil (see Appendix C). There would be some potential for introduction of exotics during early years of revegetation.

Wildlife – Work activity at proposed material sites would result in temporary loss of habitat and forage. Temporary displacement of wildlife and modification of wildlife use and movement within and adjacent to the sites might occur during periods of excavation and material processing. Migration and use patterns would be expected to reestablish following extraction. Some mortality of small wildlife, such as rodents, might occur, although this would not be expected to negatively affect populations. Reclamation following extraction might benefit wildlife by generating habitat and food sources currently unavailable at sites that were previously disturbed without restoration. Consequently, wildlife use of the newly reclaimed areas could increase. Impacts to specific wildlife populations that might be affected by extraction activities at particular sites would be analyzed and discussed in greater detail in future route-specific environmental documents.

Threatened and Endangered Species – Threatened and endangered species, such as the grizzly bear, bald eagle, and peregrine falcon, are known to inhabit areas in and around existing material sites. Temporary reactivation of a material site under a predetermined plan of operation and reclamation might, in fact, benefit some species while extraction activities without proper mitigation could adversely affect these species. For example, the restoration of habitat by rehabilitating and revegetating old material source sites could help to offset the adverse effects of road widening and other development. Additional data on the specific use of particular material sites and adjacent areas by these species must therefore be collected and analyzed in future route-specific environmental documents to ascertain the complete scope of both potential adverse and beneficial impacts. Mitigation measures to avoid or reduce adverse impacts to particular species could then be developed in consultation with the USFWS.

The area surrounding each potential material site would be surveyed for presence of nesting eagles and peregrine falcons. If nests are documented close to a material site, planned construction activities would be restricted to times that would not adversely affect nesting. Likewise, if critical use areas for grizzlies are found near potential material sites, work activities would not be allowed during critical use periods.

There would be no effect on federally listed threatened and endangered plants, as none are believed to exist in the area. Surveys would be conducted prior to the use of each material site and state-listed plants would be identified and avoided.

Floodplains/Wetlands/Water Resources and Quality – Generally, material sources in wetland sites would be avoided. If material could be obtained from dry riverbed sites, the hydrology would probably not be adversely affected because a wider channel would be available for storm runoff. However, altering channels could result in hydraulically less efficient channel geometry, which could affect short-term sediment transport processes. Fluctuations in sediment yield from these areas could result in impacts on wetland areas or fish habitat downstream. Potential riverbed sources would be evaluated in environmental documents for future route-specific road projects including potential floodplain or wetland impacts from extraction of material for the particular road segment.

On-site fuel and oil storage and handling would be in accordance with state regulations to prevent contamination of surface and subsurface waters.

Air Quality – Construction would contribute to a temporary increase in noise, dust, and fumes in local areas of material sites. Equipment on service roads, main park roads, and roads outside the park would also contribute to increased motor vehicle exhausts.

Cultural Resources. Archeological resources at material sites inside and outside of the park could be adversely affected under the proposed plan. Since it is highly unlikely that a material source containing historic structures would be selected as a preferred site, the possibility of affecting such resources under this plan is remote.

Socioeconomic Environment. Park material sources are estimated to be able to provide up to twenty percent of the road material needs for major reconstruction of the road system. This would result in significant cost savings. Use of park sources would decrease the distance and thus financial cost of hauling large volumes of processed material from distant sources. Reclamation costs would be minimized by using in-park material sites already in need of improvement. Utilizing park sources and then applying state-of-the-art reclamation efforts would allow previously and redisturbed sites to be returned to a more natural state in a cost-effective manner.

There would be aesthetic and recreational impacts on visitors from visible road material extraction and mineral aggregate processing operations. However, most operations would be out of public view. The impacts on visitors and their recreational experiences of any visible operations and the hauling of material could be mitigated through information and scheduling of hauling operations.

The potential of exhausting limited local commercial sources would be lessened by using available park material sources. Out-of-park sources would still be required to provide the majority of the road material needed to complete the road improvement, but they need not all be acquired from private sources. Some road material would also be available from other public lands. Since material would be acquired through competitive bidding and on a willing-buyer and willing-seller basis, private sources need not be exhausted.

The amount of heavy truck traffic passing through the various gateway communities would also be lessened and the impact mitigated by using some material obtained from the park.

Cumulative Effects. Cumulative effects would be similar to those described above in the "Proposed Plan for Road Improvement." The desired effect of significantly improving the road system within Yellowstone cannot be achieved without acquiring sufficient quantities of acceptable road building material. As with the proposed road improvement plan, cumulative impacts on the visitors need not be negative or extensive. Cumulative impacts on aesthetic and recreational experiences of visitors would be minimized by effective and prompt reclamation of source sites and an aggressive public information program.

Cumulative effects of obtaining this material are not totally predictable; however, some consequences can be expected. Suitable existing material sources inside the park would be utilized and then reclaimed according to current regulations (see Special Directive 91-6, appendix B). Use of material sources inside the park would decrease the total cost of the road improvement program.

Because selected material sources would not be concentrated in one location, impacts would be spread among several source locations and along several transportation routes in the GYA. Material extraction and hauling would occur over the life of the project, but the opening of new source sites and the closing and reclamation of old sites would occur in phases. Immediate impacts would be localized in space and time and cumulative effects would thus be mitigated.

Neither public nor private supplies of road material outside the park would be likely to be exhausted. However, some road material sites in close proximity to the park could be mined to the point of depletion. This could happen if demand for material is great enough and the public agencies controlling a site or the private owners of a site choose to let it happen. As long as this occurs on a willing-buyer/willing-seller basis, the cumulative impacts need not be negative. If the need for material is greater than the supply available locally, then additional material will have to be imported, at higher expense, from more distant sources.

In conclusion, GYA material sources (both inside and outside the park) would be less likely to be exhausted under the proposed plan for road material sources than under alternative BB. The flexibility of choosing from a variety of material source sites and the long-term nature of the parkwide road improvement plan would result in a diminution, both spatially and temporally, of impact. The visitors, concessioners, and the socioeconomic environment of the region would adapt to the road material extraction and hauling program required to conduct parkwide road improvement.

ROAD IMPROVEMENT ALTERNATIVES

Impacts of Alternative A: No Action

Natural Resources.

Geology/Topography/Soils/Thermal Areas — The topography, geological strata, and soil would continue to bear the impacts associated with road use and maintenance activities such as manipulation, compaction, and erosion. Rockfall on steep roadcuts would continue to be a problem. Hot spots might continue to break through the roadway, causing road destruction and unsafe driving conditions. Sinter deposition, and its removal, would continue. Material source sites would not be disturbed further.

Vegetation — Encroaching roadside vegetation would continue to limit visibility and pose a safety hazard. Removal of the vegetation would increase park operation and maintenance costs.

Wildlife — Disturbance and displacement of wildlife by the presence of the road corridor and associated maintenance activities would continue. Some roadside habitat would be periodically disturbed by maintenance work but would eventually revegetate and be reinhabited. Wildlife roadkills, especially in areas of poor sight distance, would persist. Culverts would continue to be barriers to fish passage during spawning.

Threatened and Endangered Species — There would be no new impact on threatened and endangered animal species, and no effect on any threatened or endangered plant species.

Floodplains/Wetlands/Water Resources and Quality — Floodplains or wetlands would not likely be affected by road maintenance activities.

Air Quality — Road maintenance equipment would contribute to an increase in noise, dust, and fumes during maintenance activities.

Cultural Resources. Existing road maintenance activities such as pothole patching, chip/seal application, and minor shoulder reinforcements would have no effect on adjacent cultural resources.

Socioeconomic Environment. Traffic patterns would not change appreciably since visitors are usually not aware of road conditions until they actually drive them. Even if they were made aware, most prospective visitors would not be expected to alter their plans because of this factor.

Narrow traffic lanes would continue to pose a hazard to the passage of wide vehicles going in opposite directions. Abrupt dropoffs along the roadside and at some unpaved pulloffs discourage drivers from pulling to the side to let faster moving traffic pass. The motoring public is thus inconvenienced and subjected to dangerous conditions. The lack of road shoulders is another serious condition that leaves little room for driver error. Drivers must cross into the oncoming lane in order to pass people on bicycles since bicyclists must ride in the traffic lane. A high level of skill and concentration is required to negotiate many segments of the road system. This leads to driver fatigue, some close calls, and an unpleasant visitor experience. It is only a matter of time before serious accidents become a common occurrence. The number of visitor complaints concerning the rough pavement would be expected to increase as the roads deteriorate further.

The effects of weather and heavy traffic volumes would continue to take their toll on roads. Many segments of the road system are plagued by a rough surface due to numerous potholes and patches, advanced pavement cracking, and large scale breaks due to road base and pavement failures. Existing road maintenance activities would continue. However, pothole patching and other minor maintenance activities would not forestall continued deterioration of the road system. Nor would routine maintenance do anything to improve the overall drivability or safety of the road system.

Signs and guardrails that do not meet current FHWA safety standards would not be replaced in the near future. Failure to meet current safety standards could contribute to future accidents. Slow traffic, vehicle accidents, and damage to vehicles due to inadequate roads are a problem now and are likely to increase as routine maintenance fails to address the basic structural and design problems of the road system.

Economic consequences are varied and unpredictable. Visitors (and their insurance companies) would bear the burden of individual incidents or accidents that result in personal injury, vehicle damage, and/or other personal property damage. Society (via the National Park Service) would pay the costs of providing the increasing law enforcement and other emergency services required to respond to what surely would be increasing numbers of accidents. The NPS would also have to fund high levels of road maintenance for a road system that is in an advanced stage of deterioration.

Businesses within the park and in the gateway communities probably would not be affected until road conditions deteriorate to the extent that traffic flows are substantially disrupted or road closures are required. At that time some enterprises could see their business decline or fail.

The general quality of visitor experiences would continue to be negatively impacted.

Visitors would not be subjected to short-term delays and travel interruptions caused by a planned program of ongoing road improvement, but they would be impacted by routine road maintenance activities. Such activities could become more frequent and less effective. At some point in time visitors would be subject to long-term delays and major interruptions of their travel plans due to road closures caused by unacceptable road deterioration.

Impacts of Alternative B: 3R Only

Natural Resources.

Geology/Topography/Soils/Thermal Areas – Impacts to geological resources, soil, and thermal features would be similar to but less extensive than those described in the "Proposed Plan for Road Improvement." Destruction of the bedrock, geological strata, and soil profile would occur to a lesser degree. The amount of manipulation and redistribution of geological deposits and soil within the road corridor should be less.

Vegetation – Effects on vegetation would be similar to those described in the proposed plan, but effects would be less extensive, since no major reconstruction would take place.

Wildlife – Effects on wildlife would be the same as those listed for the proposed plan regarding road improvement. The duration of disturbance to wildlife could be less due to the decreased amount of time needed to complete road rehabilitation.

Threatened and Endangered Species – The procedures to determine the full scope of potential impacts to threatened and endangered species, and necessary mitigation measures, would follow those described for the proposed plan. Therefore, the expected net effect on these species would be comparable although perhaps shorter in duration.

Effects on federally listed, state-listed, candidate plant species, and plant species of concern would be similar to those described in the proposed plan.

Floodplains/Wetlands/Water Resources and Quality – Water turbidity would be temporarily increased during construction, but would be less than that experienced in the proposed plan. Long-term erosion of road slopes would be reduced due to improved slopes and drainages. Drainage, streamflow, and storm runoff would be improved due to replacement with larger and improved culverts. Wetlands loss would be less extensive than in the proposed plan.

Construction equipment on roads and material sites could spill oil, gas, and chemical solvents into waterways.

Air Quality – Road construction equipment would contribute to an increase in noise, dust, and fumes during road rehabilitation.

Cultural Resources. Effects on cultural resources would depend on the extent of the road rehabilitation planned for a particular road segment. Typically, there might be only minor widening of the road surface in 3R projects. Therefore, there would be minimal disturbance to adjacent areas that might contain archeological resources and no effect on the historic features of the road such as bridges, culverts, guardwalls, guardrails, retaining walls, masonry gutters, and other features.

Socioeconomic Environment. Impacts would be similar to those for the proposed plan. As with the proposed plan, the negative impacts would be short-lived; however, they could be as great as those associated with the proposed plan. The positive impacts of a resurfaced, restored, and rehabilitated road system, cumulative and otherwise, would be long term. The positive impacts would not be as great as those derived from the proposed plan, because many segments of the road system would not be brought up to NPS design standards. It is expected that the short-term costs to visitors and others would be offset by long-term gains. Some improvement in driving comfort and safety would be realized. There still would be little margin for safety for either motorists or bicyclists. A program of 3R-only work for the road system is not expected to save a significant amount of time when compared to the proposed plan.

Impacts of Alternative C: MR Only

Natural Resources.

Geology/Topography/Soils/Thermal Areas — Impacts to geological resources, soil, and thermal features would be similar to but more extensive than those described in the proposed plan. Destruction of the bedrock, geological strata, and soil profile would occur to a greater degree. Manipulation and redistribution of geological deposits and soil within the road corridor would increase.

Vegetation — Effects on vegetation in road corridors would be similar to those described under the proposed plan, but effects would include a more extensive loss of vegetation because the road prism would be wider throughout more of the park road system.

Wildlife — Effects on wildlife would be the same as those listed in the proposed plan regarding road improvement. The duration of disturbance to wildlife could be greater due to the amount of time needed to complete major reconstruction of the road segments.

Threatened and Endangered Species — The procedures to determine the full scope of potential impacts to threatened and endangered species from road reconstruction, and necessary mitigation measures, would follow those described for the proposed plan. Therefore, the expected net effect on these species would be comparable, although possibly increased by the length of the project.

Effects on federally listed, state-listed, candidate plant species, and plant species of concern would be similar to those described in the proposed plan, but effects could be slightly greater due to widening of road segments.

Floodplains/Wetlands/Water Resources and Quality — Water turbidity would be temporarily increased during construction and would probably be greater than that experienced in the proposed plan. Long-term erosion of road slopes would be reduced due to improved slopes and drainages. Drainage, streamflow, and storm runoff would be improved due to replacement with larger and improved culverts. Impacts on wetlands would be greater than in the proposed plan due to widening of road segments.

Air Quality – Road construction equipment would temporarily increase noise, dust, and fumes during construction.

Cultural Resources. Under this alternative, widening road segments could cause adverse impacts to a number of archeological sites along the road system. Similarly, addition of new turnouts and/or expanded intersections could adversely affect archeological sites and necessitate mitigation prior to improvement.

The widening of segments of the park road system could have an effect on historic bridges. However, use of compatible material and sensitive design would help mitigate such effects on bridges and other roadway features. Significant features that retain their historic integrity would be indicated on a detailed mapping series provided by the FHWA in future route-specific road projects.

Socioeconomic Environment. Impacts for major reconstruction of the entire road system would be similar to those for the proposed plan except that the time frame for the work would be extended due to the type and amount of work required. This would extend the amount of time that short-term negative impacts would be experienced.

ROAD MATERIAL SOURCE ALTERNATIVES

Impacts of Alternative AA: No Action

Natural Resources.

Geology/Topography/Soils/Thermal Areas – Geological formations and soil on existing material sites would not be disturbed further. Some existing material sites that show unnatural contours would continue to be aesthetically displeasing.

Vegetation – Vegetation on existing material sites would not be disturbed further.

Wildlife – No new impacts on wildlife would occur, and wildlife would not benefit from the rehabilitation of material sites.

Threatened and Endangered Species – There would be no new effects on any threatened and endangered species.

Floodplains/Wetlands/Water Resources and Quality – There would be no additional effects on floodplains or wetlands.

Air Quality — There would be no effect on air quality.

Cultural Resources. The effects on cultural resources on private lands would be similar to those described above in the proposed plan.

Socioeconomic Environment. With the no action alternative, the park's need to supply road maintenance activities would continue, and increase as road deterioration accelerated. Outside sources would be used with impacts similar to those described in alternative BB, described below.

Impacts of Alternative BB: Out-of-Park Sources Only

Natural Resources.

Geology/Topography/Soils/Thermal Areas — Impacts to geological resources, soil, and thermal features would be similar to those described for the proposed plan. Material would be obtained from commercial sources outside the park and from sources on other public lands. Cooperation between the Park Service and other public agencies would be needed for use of these material sites, and preparation of compliance documents would be required. Use of all material sites would require approval of required state permits. Sites on public lands would be reclaimed and recontoured to blend with surrounding environment.

Vegetation — Vegetation covering material extraction sites would be disturbed, although these previously disturbed sites often have a reduced vegetational cover. Material sites located on other public lands would be revegetated according to a reclamation plan with material approved by the administering public agency.

Wildlife — Impacts to wildlife would be similar to those described for the proposed plan although they would take place only on lands outside of the park.

Threatened and Endangered Species — The procedure to determine the full scope of potential impacts to threatened and endangered species from extraction activities, and necessary mitigation measures, in addition to subsequent reclamation, would follow that described in the "Proposed Plan for Road Material Sources." Therefore, the expected net effect on these species would be comparable.

Effects on federally listed and state-listed threatened and endangered plant species would be similar to those described in the proposed plan.

Floodplains/Wetlands/Water Resources and Water Quality — Possible effects on floodplains are unknown and wetlands would be avoided on public lands outside the park.

Air Quality – Extraction and processing of material would cause noise, dust, and fumes in the areas of material sites. Greater hauling distances from out-of-park sources would adversely affect air quality, due to greater amounts of motor vehicle exhaust fumes.

Cultural Resources. The effects on cultural resources on public or private lands outside the park would be similar to those described above in the "Proposed Plan for Road Material Sources."

Socioeconomic Environment. The major consequence of this alternative is to increase the dollar cost of completing the improvement of the road system. Greater hauling distances would be required to complete a given segment of the park road.

Truck traffic to and from the park would increase. This action would result in more congestion, more wear and tear on road surfaces, an increased potential for accidents, and decreased quality of visitors' experiences. This alternative would require a greater expenditure of limited funds for acquisition and transportation of road material.

This alternative would also result in the disturbance of additional new potential sites or greater disturbance of existing sites. Requiring all road improvement material to be obtained outside the park would result in no new disturbance of existing road material sites in the park, but the opportunity to use suitable sites within the park and then properly reclaim them as part of the road improvement program would be foregone.

Aesthetic and recreational impacts on visitors might not be as great within the park. This benefit could be offset by transferring the impacts to people traveling to and from the park and using public lands outside the park.

The possibility of park material needs exhausting limited local commercial sources could be increased. Out-of-park sources would be required to provide all of the road material needed to complete the road improvement, but need not all be private sources. Some road material would also be available from other public lands. Exhaustion of local sources may not be a problem because material would be acquired through competitive bidding and on a willing-buyer and willing-seller basis. Thus private sources need not exhaust their supplies unless they so desire. Prices could rise due to the increased demand by the park for the limited road materials that are available outside the park.

FUTURE COMPLIANCE REQUIREMENTS

Separate route- and design-specific environmental documents would be prepared as needed for each road improvement project in Yellowstone to evaluate the project-specific effects of road improvement and extraction from selected potential material sources and to provide current compliance information. Such environmental documents would be used for application for project-specific permits and compliance.

SECTION 106, NATIONAL HISTORIC PRESERVATION ACT

Under the terms and conditions of the NPS Programmatic Memorandum of Agreement of August 15, 1990, this draft plan/EA was submitted for review and comment to the Montana, Wyoming, and Idaho State Historic Preservation Offices (SHPO) as well as to the Advisory Council on Historic Preservation (ACHP). The consultation will be concluded by developing a Memorandum of Agreement that will establish a structure and mechanism for establishing eligibility, determining effects, and providing for mitigation.

When future route-specific projects are funded, the appropriate SHPO will be afforded an opportunity to review and comment on preliminary design drawings and archeological surveys. The National Park Service will ensure that all work is carried out in accordance with *The Secretary of the Interior Standards for Rehabilitation* and *The Secretary of the Interior Standards and Guidelines for Archeology and Historic Preservation*. Appropriate mitigation as prescribed by the standards will be completed in consultation with the SHPO.

SECTION 404, CLEAN WATER ACT

Applications for Section 404 permits would be made by the FHWA and submitted to the Army Corps of Engineers for future route-specific environmental documents. These permits are required for discharge of roadway fill material into waters of the United States, including wetlands and waterways.

EXECUTIVE ORDERS 11988 AND 11990

Environmental documents would be prepared whenever adverse impacts on floodplains or wetlands could be expected from proposed plans. Environmental documents would be made available for public review for not less than 60 days prior to issuing a Finding of No Significant Impact (FONSI) or a Notice of Intent (NOI) to prepare an Environmental Impact Statement. When the action would involve adverse impacts to wetland or floodplain areas, the FONSI or Final Environmental Impact Statement would be coupled with a separate Statement of Findings (SOF) document.

STORM WATER RULE

The Storm Water Rule (40 CFR, Parts 122, 123, and 124) requires a National Pollution Discharge Elimination System (NPDES) permit on certain categories of storm water discharge. Road construction, such as clearing and grading activities that exceed five acres on an individual road project, would require a NPDES permit.

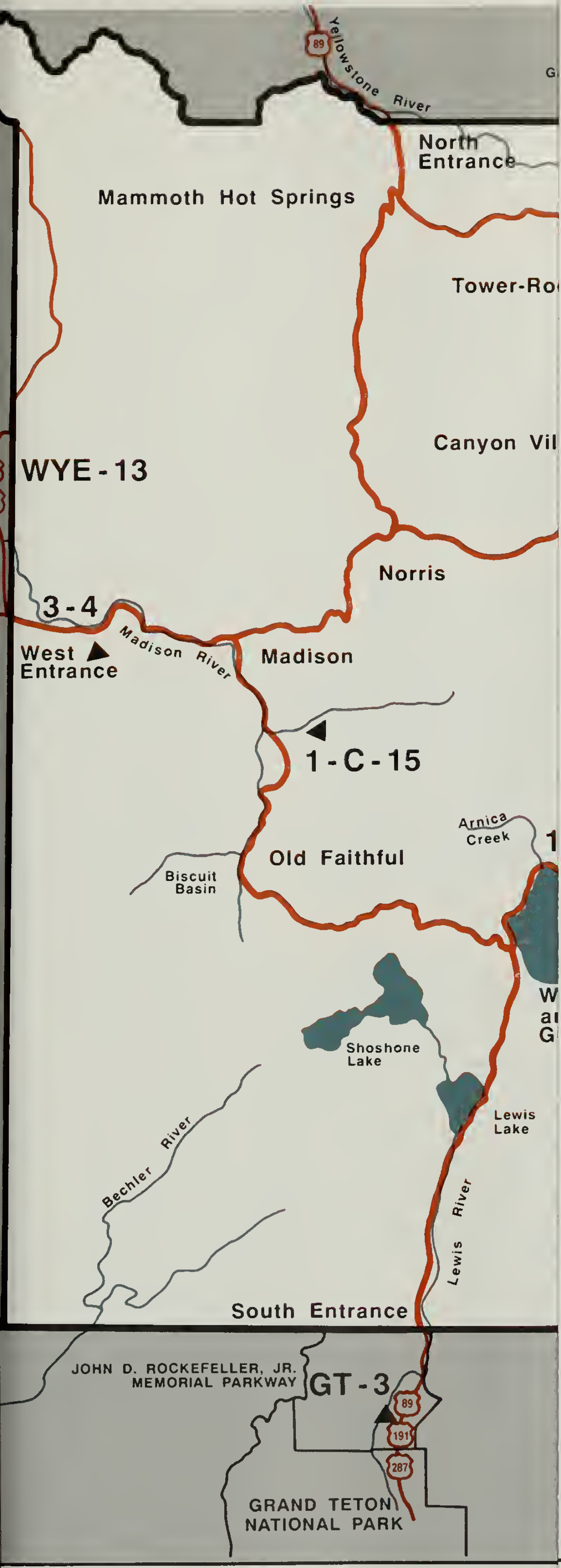
SECTION 7- ENDANGERED SPECIES ACT

Informal consultation with the USFWS will be initiated by the Park Service on all proposed future road improvement to comply with the Endangered Species Act of 1973, as amended. The National Park Service will coordinate with the USFWS to analyze potential impacts and develop mitigation measures. Formal consultation with the USFWS will be requested if it is determined that the proposed plan is likely to adversely affect any threatened or endangered species.

AGENCIES/ORGANIZATIONS CONTACTED

Advisory Council on Historic Preservation
Bozeman Area Chamber of Commerce
Cody Economic Development Council
Cooke City Chamber of Commerce
Dubois Chamber of Commerce
Gardiner Chamber of Commerce
Greater Idaho Falls Chamber of Commerce
Idaho State Historic Preservation Office
Jackson Hole Chamber of Commerce
Livingston Chamber of Commerce
Montana State Historic Preservation Office
Red Lodge Area Chamber of Commerce
U.S. Army Corps of Engineers
U.S. Forest Service
U.S. Fish and Wildlife Service
West Yellowstone Chamber of Commerce
Wyoming State Historic Preservation Office

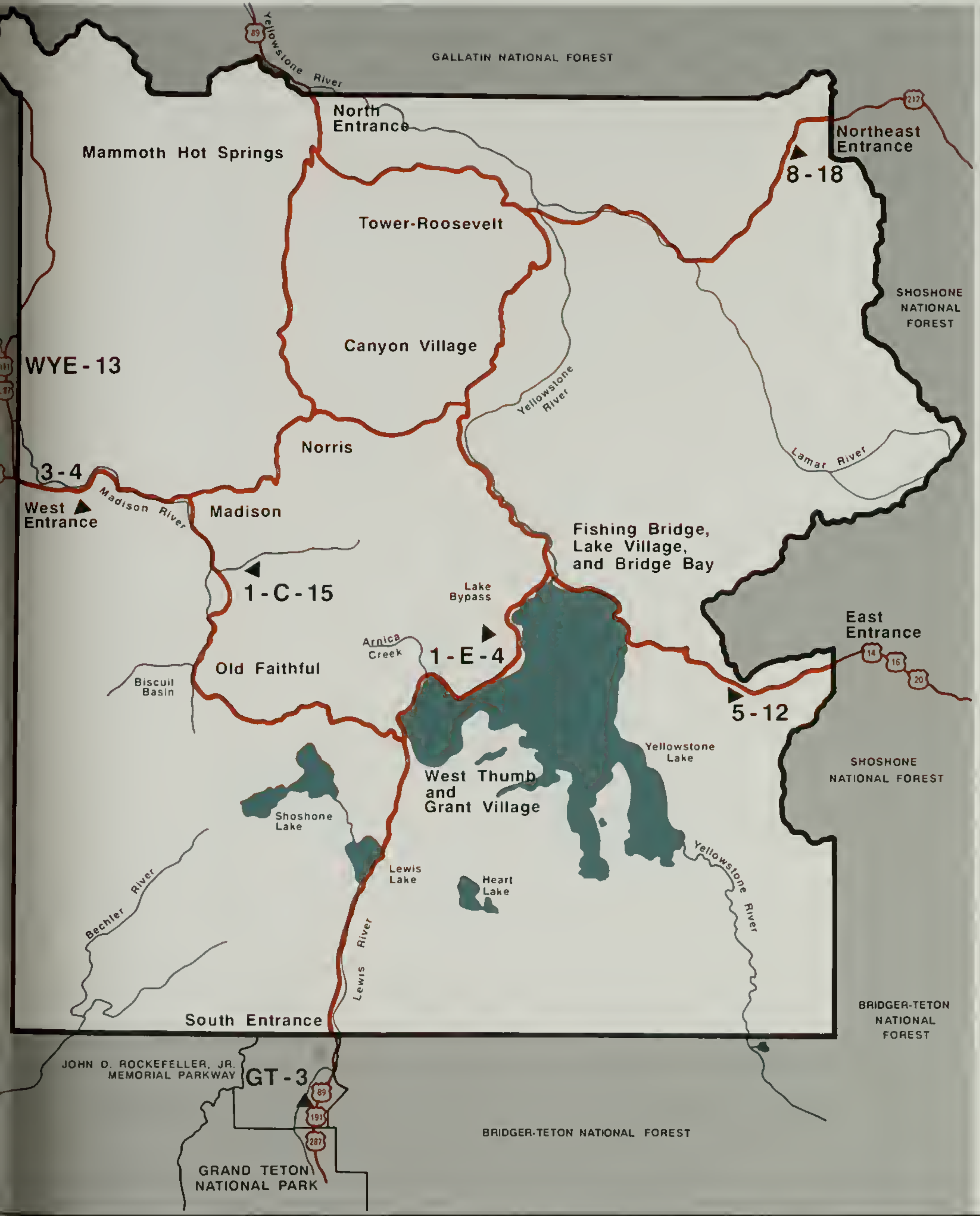
APPENDIX A



RECOMMENDED MATERIAL SOURCES AND OTHER USES

YELLOWSTONE NATIONAL PARK

UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE
DSC / FEB '92 / 101 / 40267



SITES ▲	NAME
8-18	Soda Butte Creek Dry Wash
1-E-4	Bridge Bay Quarry
5-12	Sylvan Pass Pit
GT-3	Snake River Pit #2
1-C-15	Nez Perce Quarry
WYE-13	Commercial Site In West Yellowstone Area
3-4	Old Fountain Trail Pit

RECOMMENDED MATERIAL SOURCES AND OTHER USES

YELLOWSTONE NATIONAL PARK

UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE
OSC / FEB '92 / 101 / 40267

APPENDIX A (Modified from FHW

QUADRANGLE	NUMBER		NAME	ADMINISTRATION OR OWNERSHIP NPS ADMIN.	FS. ADMIN.	STATE ADMIN.	PRIVATE PROP.
Abiathar Peak	1.	8-9A	Lamar Ranger Sta. R.	X			
	2.	8-9B	Lamar Ranger Sta. Pi	X			
	3.	8-10	Lamar R. Picnic A. E	X			
	4.	8-11	Trout Lake Pit	X			
	5.	8-12	Soda Butte Cr. Tops.	X			
	6.	8-13	Pebble Creek Pit	X			
	7.	8-14	Pebble Creek Quarry	X			
	8.	8-15	Soda Butte South Pit	X			
	9.	8-16	Soda Butte North Pit	X			
	10.	8-18	Soda Butte Cr. Dry W	X			
	11.	8-19	Icebox Canyon	X			
Beartooth Butte	1.	CC-9	Lily Lake Site		X		
	2.	CC-10	Ghost Cr. Pit(Muddy		X		
	3.	CC-11	Clarks Fork Trlhd. S		X		
	4.	CC-12	Crandall Park Pit		X		
Canyon Village	1.	1-E-4	Bridge Bay Quarry	X			
	2.	1-E-5	Natural Bridge Pit	X			
	3.	1-E-6	Lake Incinerator Pit	X			
	4.	1-F1P	Fishing Bridge #1 Pi	X			
	5.	1-F2P	Fishing Bridge #2 Pi	X			
	6.	1-F3P	Trout Creek Pit	X			
	7.	1-F4P	Hayden Valley Pit	X			
	8.	1-G-7	Canyon U. Srvce. Rd	X			
	9.	1-G-8	Old Canyon Campgr. E	X			
	10.	5-1	Pelican Cr Campgr. E	X			
	11.	5-2	Squaw Lake Pit	X			
	12.	5-3	Sedge Creek Pit East	X			
	13.	5-4	Sedge Creek Pit West	X			
	14.	5-5	Old Butte Springs Pi	X			
	15.	5-6	Lake Butte Talus Pit	X			
	16.	5-7	Lake Butte South	X			
	17.	5-19	Fishing Bridge Pit	X			
Chimney R.	1.	5-20	Goff Creek Pit		X		
Clayton Mt.	1.	5-21	Mummy Cave Pit		X		
Cliff Lake	1.	WYE-6	Trout Creek Pit			X	
Cooke City	1.	CC-1	Cooke City Tailings				X
	2.	CC-2	Cooke City Pit		X		
	3.	CC-3	Lulu Pass # 1		X		
	4.	CC-4	Lulu Pass # 2		X		
	5.	CC-5	State Line Talus N &		X		
	6.	CC-14	Daisy Pass Road Area		X		
	7.	CC-15	New World Mines				X

1
POTENTIAL MINERAL AGGREGATE SITE STATUS MATRIX

APPENDIX A (Modified from FHWA 1991b) **YELLOWSTONE NATIONAL PARK**

QUADRANGLE	NUMBER	NAME	PRELIMINARY RECOMMENDATION				REASON(S) FOR PRELIMINARY RECOMMENDATION														ADMINISTRATION OR OWNERSHIP			
			USE	NO USE	POSSIBLE USE	MORE INVSTG.	SITE RCLAIMD	NEEDS RCLMATN	POOR QUAL.	SMALL QUANT.	SOURCE DEPLTED	POOR ACCESS	AGENCY DECISN	HIGHLY VISIBLE	SNSITVE AREA	GEOTHRM AREA	PUB USE AREA	ADMIN AREA	NOT LOCATED	OTHER USE	NPS ADMIN	FS. ADMIN	STATE ADMIN	PRIVATE PROP.
Abiathar Peak	1. B-9A	Lamar Ranger Sta. R. Pit		X									X	X	X					X	X			
	2. B-9B	Lamar Ranger Sta. Pit		X									X					X			X			
	3. B-10	Lamar R. Picnic A. Pit		X									X	X	X		X				X			
	4. B-11	Trout Lake Pit		X									X	X	X						X			
	5. B-12	Soda Butte Cr. Tops. Pit		X									X	X	X						X			
	6. B-13	Pebble Creek Pit		X									X	X	X						X			
	7. B-14	Pebble Creek Quarry		X									X								X			
	8. B-15	Soda Butte South Pit				X													X		X			
	9. B-16	Soda Butte North Pit		X									X								X			
	10. B-18	Soda Butte Cr. Dry Wash	X			X		X						X							X			
	11. B-19	Icebox Canyon		X									X	X	X						X			
Beartooth Butte	1. CC-9	Lily Lake Site				X																X		
	2. CC-10	Ghost Cr. Pit(Muddy Cr).			X	X		X														X		
	3. CC-11	Clarks Fork Trlhd. Site		X										X			X			X		X		
	4. CC-12	Crandall Park Pit			X			X														X		
Canyon Village	1. 1-E-4	Bridge Bay Quarry	X			X		X							X						X			
	2. 1-E-5	Natural Bridge Pit		X				X			X				X			X		X	X			
	3. 1-E-6	Lake Incinerator Pit		X				X			X				X			X		X	X			
	4. 1-F1P	Fishing Bridge #1 Pit		X									X	X	X						X			
	5. 1-F2P	Fishing Bridge #2 Pit		X									X	X	X						X			
	6. 1-F3P	Trout Creek Pit		X			X						X		X						X			
	7. 1-F4P	Hayden Valley Pit		X									X	X	X						X			
	8. 1-G-7	Canyon U. Srvce. Rd. Pit		X			X				X							X		X	X			
	9. 1-G-8	Old Canyon Campgr. Pit		X				X			X							X		X	X			
	10. 5-1	Pelican Cr Campgr. Pit		X			X						X		X						X			
	11. 5-2	Squaw Lake Pit		X				X							X						X			
	12. 5-3	Sedge Creek Pit East		X									X	X	X						X			
	13. 5-4	Sedge Creek Pit West		X									X	X	X						X			
	14. 5-5	Old Butte Springs Pit		X				X	X												X			
	15. 5-6	Lake Butte Talus Pit			X	X		X	X									X			X			
	16. 5-7	Lake Butte South		X									X	X	X						X			
	17. 5-19	Fishing Bridge Pit		X			X		X									X			X			
Chimney R.	1. 5-20	Goff Creek Pit		X		X		X	X													X		
Clayton Mt.	1. 5-21	Mummy Cave Pit		X		X			X					X	X							X		
Cliff Lake	1. WYE-6	Trout Creek Pit			X	X		X												X			X	
Cooke City	1. CC-1	Cooke City Tailings Pond		X			X		X															X
	2. CC-2	Cooke City Pit		X				X	X													X		
	3. CC-3	Lulu Pass # 1			X	X																X		
	4. CC-4	Lulu Pass # 2			X	X																X		
	5. CC-5	State Line Talus N & S			X	X		X						X								X		
	6. CC-14	Daisy Pass Road Area		X								X		X								X		
	7. CC-15	New World Mines			X	X														X				X

1
POTENTIAL
MINERAL
AGGREGATE
SITE STATUS
MATRIX

APPENDIX A (Modified from FHW

QUADRANGLE	NUMBER		NAME	ADMINISTRATION OR OWNERSHIP			
				NPS ADMIN.	FS. ADMIN.	STATE ADMIN.	PRIVATE PROP.
Cutoff Mountain	1.	8-20	Warm Springs Picnic A	X			
	2.	8-17	Ranger Res. West Pit	X			
Deep Lake	1.	CC-13	Dead Indian Creek Pit		X		
Eagle Peak	1.	5-9	Cub Creek Quarry	X			
	2.	5-10	Sylvan Lake North	X			
	3.	5-11	Sylvan Lake Pit	X			
	4.	5-12	Sylvan Pass Pit	X			
	5.	5-13	Sylvan Pass East Pit	X			
	6.	5-14	Middle Creek Quarry	X			
	7.	5-15	Line Change Quarry	X			
	8.	5-16	1961 Survey Pit	X			
	9.	5-17	Service Rd Junction	X			
	10.	5-18	East Entrance Pit	X			
Fridley Pk.	1.	GN-21	Point of Rocks Pit			X	
Gardiner	1.	GN-6	Northern Pacific Pit	X			
	2.	GN-7	Gardiner Cemetery Pi	X			
	3.	GN-8	Laubach Pit				X
	4.	GN-11	Gresswell Pit				X
	5.	GN-15	Jardine Pit				X
	6.	GN-16	Eagle Creek Pit		X		
	7.	GN-17	Phelps Creek Quarry				X
	8.	GN-18	Phelps Creek Quarry				X
	9.	GN-19	Jardine Road Quarry				X
	10.	GN-20	Gardiner Basalt Pit				X
	13.	GN-24	Little Trail Cr. Sit		X		
Hebgen Dam	1.	WYE-3	Watkins Creek Pit		X		
Henrys Lake	1.	WYE-4	Targhee Creek Pit			X	
	2.	WYE-5	North Henrys Lake Pi			X	
Huckleberry Mountain	1.	4-15	Plateau Trail Pit	X			
	2.	4-16	Lewis R. Gooseneck P	X			
	3.	4-17	Old Lewis Canyon Rd	X			
	4.	4-18	Crawfish Creek Pit	X			
	5.	4-19	Lewis-Snake River Pi	X			
	6.	4-20	Snake River Bar Pit	X			
	7.	GT-1	Dime Creek Pit	X			
	8.	GT-2	Snake River Pit #1	X			
	9.	GT-3	Snake River Pit # 2	X			
	10.	GT-4	Flagg Ranch Site #1	X			
	11.	GT-5	Flagg Ranch Site #2	X			
	12.	GT-6	Flagg Ranch Site #3	X			
	13.	GT-7	Snake R. Ranger Sta	X			

APPENDIX A (Modified from FHWA 1991b) YELLOWSTONE NATIONAL PARK

QUADRANGLE		NUMBER	NAME	PRELIMINARY RECOMMENDATION				REASON(S) FOR PRELIMINARY RECOMMENDATION														ADMINISTRATION OR OWNERSHIP			
				USE	NO USE	POSSIBLE USE	MORE INVSTG.	SITE RCLAIMD	NEEDS RCLMATN	POOR QUAL.	SMALL QUANT	SOURCE DEPLTED	POOR ACCESS	AGENCY DECISN	HIGHLY VISIBLE	SNSITVE AREA	GEOTHRM AREA	PUB USE AREA	ADMIN. AREA	NOT LOCATED	OTHER USE	NPS ADMIN	FS. ADMIN.	STATE ADMIN.	PRIVATE PROP.
Cutoff Mountain	1.	8-20	Warm Springs Picnic A.		X								X	X								X			
	2.	8-17	Ranger Res. West Pit		X					X			X	X		X						X			
Deep Lake	1.	CC-13	Dead Indian Creek Pit		X				X						X						X		X		
Eagle Peak	1.	5-9	Cub Creek Quarry						X										X			X			
	2.	5-10	Sylvan Lake North		X									X	X	X						X			
	3.	5-11	Sylvan Lake Pit		X				X	X						X						X			
	4.	5-12	Sylvan Pass Pit	X			X		X						X							X			
	5.	5-13	Sylvan Pass East Pit		X					X					X							X			
	6.	5-14	Middle Creek Quarry		X					X				X	X							X			
	7.	5-15	Line Change Quarry		X					X					X							X			
	8.	5-16	1961 Survey Pit		X					X					X							X			
	9.	5-17	Service Rd Junction Pit		X																	X			
	10.	5-18	East Entrance Pit			X	X						X		X							X			
Fridley Pk.	1.	GN-21	Point of Rocks Pit		X				X			X			X									X	
Gardiner	1.	GN-6	Northern Pacific Pit		X										X							X			
	2.	GN-7	Gardiner Cemetery Pit			X	X		X						X				X			X			
	3.	GN-8	Lanbach Pit		X				X			X													X
	4.	GN-11	Gresswell Pit		X			X																	X
	5.	GN-15	Jardine Pit		X										X										X
	6.	GN-16	Eagle Creek Pit			X	X						X							X			X		
	7.	GN-17	Phelps Creek Quarry # 1		X				X	X					X						X				X
	8.	GN-18	Phelps Creek Quarry # 2		X				X	X					X						X				X
	9.	GN-19	Jardine Road Quarry		X				X	X					X										X
	10.	GN-20	Gardiner Basalt Pit			X	X								X										X
	13.	GN-24	Little Trail Cr. Site			X	X																X		
Hebgen Dam	1.	WYE-3	Watkins Creek Pit			X	X	X					X										X		
Henrys Lake	1.	WYE-4	Targhee Creek Pit			X	X		X						X									X	
	2.	WYE-5	North Henrys Lake Pit		X				X	X					X									X	
Huckleberry Mountain	1.	4-15	Plateau Trail Pit		X																	X			
	2.	4-16	Lewis R. Gooseneck Pit		X				X							X						X			
	3.	4-17	Old Lewis Canyon Rd Pit			X	X						X									X			
	4.	4-18	Crawfish Creek Pit		X				X										X			X			
	5.	4-19	Lewis-Snake River Pit		X			X					X			X						X			
	6.	4-20	Snake River Bar Pit		X			X							X	X						X			
	7.	GT-1	Dime Creek Pit		X									X		X						X			
	8.	GT-2	Snake River Pit #1		X				X										X			X			
	9.	GT-3	Snake River Pit # 2	X					X										X			X			
	10.	GT-4	Flagg Ranch Site #1		X									X		X						X			
	11.	GT-5	Flagg Ranch Site #2		X									X		X			X			X			
	12.	GT-6	Flagg Ranch Site #3		X									X								X			
	13.	GT-7	Snake R. Ranger Sta Pit		X									X					X			X			

APPENDIX A (Modified from FHW

QUADRANGLE	NUMBER	NAME	ADMINISTRATION OR OWNERSHIP NPS ADMIN.	FS. ADMIN.	STATE ADMIN.	PRIVATE PROP.
Madison Junction	1. 3-1	Mount Jackson Pit	X			
	2. 3-1A	Mt. Jackson Talus Q	X			
	3. 3-2&3	West Mt. Haynes Pit	X			
	4. 3-8	Madison Lagoon Pit	X			
	5. 1-B-4	Secret Valley Pit	X			
	6. 1-B-5	Mesa Road Bridge Pi	X			
	7. 1-B-6	Tuff Cliff Pit	X			
	8. 1-B-7	Terrace Spring Pit	X			
	9. 1-B-8	Madison Junction Pi	X			
	10. 1-C-2	Mesa Road Center Pi	X			
	11. 1-C2A	Mesa Burn Pit	X			
	12. 1-C2B	Mesa Maintenance Si	X			
	13. 1-C-3	Mesa Road West Pit	X			
	14. 1-C-4	Fairy Falls Ent Rd	X			
	15. 1-C-5	Goose Lake Pit	X			
	16. 1-C-6	Hot Lake Pit	X			
	17. 1-C-7	Hot Lake Kame Pit	X			
	18. 1-C-8	Tangled Creek Pit	X			
	19. 1-C-9	S. Ent Firehole Loo	X			
	20. 1-C10	Whiskey Flats Pit	X			
	21. 1-C11	(& 12) Rabbit Creek	X			
	22. 1-C14	Firehole # 1 Pit	X			
	23. 1-C15	Nez Perce Quarry	X			
Mammoth	1. 1-A-1	Swan Lake Talus	X			
	2. 1-A-2	Swan Lake Pit East	X			
	3. 1-A-3	Swan Lake Flats Pit	X			
	4. 1-A-4	Swan Lake Pit West	X			
	5. 1-A-5	Apollinaris Spr. S.	X			
	6. 1-A-6	Semi-Centenn. Geys.	X			
	7. 1-A-7	Swan Lake Pit North	X			
	8. 1-A-8	Bunsen Peak West Pi	X			
	9. 1-A-9	Glen Creek Site	X			
	10. 1-A10	Upper Mammoth Res.	X			
	11. 1-A11	Upper Mammoth Terra	X			
	12. 1-A12	Indian Creek Campgr	X			
	13. 1-H-4	Phantom Lake Pit	X			
	14. 1-H-5	Frog Rock East Exte	X			
	15. 1-H-6	Frog Rock Pit	X			
	16. 1-H-7	Elk Rocks Pit	X			
	17. 1-H-8	Blacktail Patr. Cab	X			
	18. 1-H-9	Blacktail Deer Cree	X			
	19. 1-H10	Wraith Falls Site	X			
	20. 1-H11	Lava Creek Campgr.	X			
	21. 1-H12	Lava Creek Canyon	X			
	22. 1-H13	Capital Hill Pit	X			

3

POTENTIAL MINERAL AGGREGATE SITE STATUS MATRIX

APPENDIX A (Modified from FHWA 1991b)

YELLOWSTONE NATIONAL PARK

QUADRANGLE		NUMBER	NAME	PRELIMINARY RECOMMENDATION				REASON(S) FOR PRELIMINARY RECOMMENDATION														ADMINISTRATION OR OWNERSHIP			
				USE	NO USE	POSSIBLE USE	MORE INVSTG.	SITE RCLAIMD	NEEDS RCLMATN	POOR QUAL.	SMALL QUANT.	SOURCE DEPLTED	POOR ACCESS	AGENCY DECISN	HIGHLY VISIBLE	SNSITVE AREA	GEOTHRM AREA	PUB USE AREA	ADMIN. AREA	NOT LOCATED	OTHER USE	NPS ADMIN.	FS. ADMIN	STATE ADMIN.	PRIVATE PROP.
Madison Junction	1.	3-1	Mount Jackson Pit		X				X					X								X			
	2.	3-1A	Mt. Jackson Talus Quarry		X				X					X	X							X			
	3.	3-2&3	West Mt. Haynes Pits			X	X		X										X			X			
	4.	3-8	Madison Lagoon Pit		X			X				X							X		X	X			
	5.	1-B-4	Secret Valley Pit		X				X													X			
	6.	1-B-5	Mesa Road Bridge Pit		X								X	X	X							X			
	7.	1-B-6	Tuff Cliff Pit		X									X								X			
	8.	1-B-7	Terrace Spring Pit		X									X		X	X					X			
	9.	1-B-8	Madison Junction Pit		X				X													X			
	10.	1-C-2	Mesa Road Center Pit		X				X			X							X		X	X			
	11.	1-C2A	Mesa Burn Pit		X				X			X							X		X	X			
	12.	1-C2B	Mesa Maintenance Site		X				X			X							X		X	X			
	13.	1-C-3	Mesa Road West Pit		X										X							X			
	14.	1-C-4	Fairy Falls Ent Rd Pit		X					X					X							X			
	15.	1-C-5	Goose Lake Pit		X					X					X	X						X			
	16.	1-C-6	Hot Lake Pit		X			X		X				X								X			
	17.	1-C-7	Hot Lake Xame Pit		X			X		X				X								X			
	18.	1-C-8	Tangled Creek Pit		X				X	X						X						X			
	19.	1-C-9	S. Ent Firehole Loop Pit		X				X	X						X						X			
	20.	1-C10	Whiskey Flats Pit		X				X	X						X						X			
	21.	1-C11	(& 12) Rabbit Creek Pits		X			X				X		X					X		X	X			
	22.	1-C14	Firehole # 1 Pit		X			X				X							X		X	X			
	23.	1-C15	Nez Perce Quarry	X			X		X							X	X					X			
Mammoth	1.	1-A-1	Swan Lake Talus		X									X	X							X			
	2.	1-A-2	Swan Lake Pit East		X				X			X							X		X	X			
	3.	1-A-3	Swan Lake Flats Pit		X				X					X					X			X			
	4.	1-A-4	Swan Lake Pit West			X	X		X										X			X			
	5.	1-A-5	Apollinaris Spr. S. Pit		X				X	X					X	X						X			
	6.	1-A-6	Semi-Centenn. Geys. Pit		X					X			X			X						X			
	7.	1-A-7	Swan Lake Pit North		X				X						X	X						X			
	8.	1-A-8	Bunsen Peak West Pit		X				X						X							X			
	9.	1-A-9	Glen Creek Site		X									X	X							X			
	10.	1-A10	Upper Mammoth Res. Area		X														X			X			
	11.	1-A11	Upper Mammoth Terrace A.		X									X	X							X			
	12.	1-A12	Indian Creek Campgr. S.		X									X				X		X		X			
	13.	1-B-4	Phantom Lake Pit		X									X								X			
	14.	1-H-5	Frog Rock East Extension		X									X								X			
	15.	1-H-6	Frog Rock Pit			X	X		X	X									X			X			
	16.	1-B-7	Elk Rocks Pit		X				X	X				X					X		X	X			
	17.	1-H-8	Blacktail Patr. Cab. Pit		X				X	X						X			X			X			
	18.	1-H-9	Blacktail Deer Creek		X									X	X	X						X			
	19.	1-H10	Wraith Falls Site		X									X	X							X			
	20.	1-H11	Lava Creek Campgr. Pit		X									X	X	X		X				X			
	21.	1-B12	Lava Creek Canyon Talus		X									X	X	X						X			
	22.	1-B13	Capital Hill Pit		X			X							X	X						X			

APPENDIX A (Modified from FHW

QUADRANGLE	NUMBER	NAME	ADMINISTRATION OR OWNERSHIP			
			NPS ADMIN.	FS. ADMIN.	STATE ADMIN.	PRIVATE PROP.
Miner	1. GN-1	Reese Creek Pit	X			
	2. GN-2	Railroad Wye Pit	X			
	3. GN-3	Stephens Cr. Nurser	X			
	4. GN-4	Ranger. Sta. Entr.	X			
	5. GN-5	Stephens Creek Pit	X			
	6. GN-9	Pappesh Pit				X
	7. GN-10	Hoppe Pit				X
	8. GN-12	Brogan Pit # 1				X
	9. GN-13	Brogan Pit # 2				X
	10. GN-14	Tom Miner Basin Pit				X
	11. GN-22	Carbella Bar Pits			X	
	12. GN-23	Royal Teton Ranch P				X
Norris Junction	1. 16-1	Norris Debris Dump				
	2. 16-2	Norris Pit & Maint	X			
	3. 16-3	Ice Lake Quarry	X			
	4. 16-4	Virginia Meadows Si	X			
	5. 16-5	Crystal F. Srv. Rd.	X			
	6. 1-B-1	Gibbon Meadows Pit	X			
	7. 1-B-2	Gibbon High Cut Pit	X			
	8. 1-B-3	Gibbon Power Line P	X			
Old Faithful	1. 1-C13	Old Faithful Pit	X			
	2. 1-D-1	Lone Star Geyser Pi	X			
Pelican Cn.	1. 5-8	Cub Creek Gravel Pi	X			
Pilot Peak	1. CC-6	Index Creek Bridge		X		
	2. CC-7	Fox Creek Bridge Si		X		
	3. CC-8	Pilot Creek Pit		X		
Teepee Cr.	1. WYE-7	Johnson Creek Pit				X
	2. WYE-8	Grayling South Pit		X		
	3. WYE-9	Catfish Lane Pit				X
	4. WYE10	Grayling Private Pi				X
	5. WYE11	Grayling North Pit		X		
	6. WYE12	Old Cabin Pit				X
	7. WYE13	Bozeman Sand & Grav				X
Tower Junction	1. 8-1	Tower Junction Pit	X			
	2. 8-2	Junction Butte Pit	X			
	3. 8-3&4	Little America Pit	X			
	4. 8-5	Crystal Creek Pit	X			
	5. 8-6	Lamar River Quarry	X			

4

POTENTIAL MINERAL AGGREGATE SITE STATUS MATRIX

APPENDIX A (Modified from FHWA 1991b)

YELLOWSTONE NATIONAL PARK

QUADRANGLE	NUMBER	NAME	PRELIMINARY RECOMMENDATION				REASON(S) FOR PRELIMINARY RECOMMENDATION														ADMINISTRATION OR OWNERSHIP			
			USE	NO USE	POSSI-BLE USE	MORE INVSTG.	SITE RCLAIMD	NEEDS RCLMATN	POOR QUAL.	SMALL QUANT.	SOURCE DEPLTED	POOR ACCESS	AGENCY DECISN	HIGHLY VISIBLE	SNSITVE AREA	GEOTHRM AREA	PUB USE AREA	ADMIN. AREA	NOT LOCATED	OTHER USE	NPS ADMIN.	FS. ADMIN	STATE ADMIN.	PRIVATE PROP.
Miner	1. GN-1	Reese Creek Pit			X		X														X			
	2. GN-2	Railroad Wye Pit		X										X							X			
	3. GN-3	Stephens Cr. Nursery Pit		X														X			X			
	4. GN-4	Ranger. Sta. Entr. Pit		X										X							X			
	5. GN-5	Stephens Creek Pit		X										X							X			
	6. GN-9	Pappeah Pit		X				X		X				X										X
	7. GN-10	Hoppe Pit		X			X				X			X						X				X
	8. GN-12	Brogan Pit # 1		X				X		X				X										X
	9. GN-13	Brogan Pit # 2		X				X			X			X										X
	10. GN-14	Tom Miner Basin Pit		X				X		X				X										X
	11. GN-22	Carbella Bar Pits			X	X		X									X			X			X	
	12. GN-23	Royal Teton Ranch Pit			X	X		X																X
Norris Junction	1. 16-1	Norris Debris Dump Site		X		X		X			X							X		X				
	2. 16-2	Norris Pit & Maint Site		X				X			X							X		X	X			
	3. 16-3	Ice Lake Quarry			X	X		X							X			X			X			
	4. 16-4	Virginia Meadows Site		X										X	X						X			
	5. 16-5	Crystal F. Srv. Rd. Pit		X				X			X							X		X	X			
	6. 1-B-1	Gibbon Meadows Pit		X				X	X		X										X			
	7. 1-B-2	Gibbon High Cnt Pit		X					X					X							X			
	8. 1-B-3	Gibbon Power Line Pit		X					X												X			
Old Faithful	1. 1-C13	Old Faithful Pit		X			X				X							X		X	X			
	2. 1-D-1	Lone Star Geyser Pit		X				X				X									X			
Pelican Cn.	1. 5-8	Cub Creek Gravel Pit		X				X	X												X			
Pilot Peak	1. CC-6	Index Creek Bridge Site		X					X					X								X		
	2. CC-7	Fox Creek Bridge Site		X										X								X		
	3. CC-8	Pilot Creek Pit						X														X		
Teepee Cr.	1. WYE-7	Johnson Creek Pit			X	X		X						X										X
	2. WYE-8	Grayling South Pit		X				X					X	X	X							X		
	3. WYE-9	Catfish Lane Pit			X	X		X	X	X														X
	4. WYE10	Grayling Private Pit			X	X		X	X					X										X
	5. WYE11	Grayling North Pit		X				X					X									X		
	6. WYE12	Old Cabin Pit			X	X		X	X					X										X
	7. WYE13	Bozeman Sand & Grav. Pit	X					X	X					X										X
Tower Junction	1. 8-1	Tower Junction Pit		X				X						X			X				X			
	2. 8-2	Junction Butte Pit		X								X									X			
	3. 8-3&4	Little America Pit			X	X		X	X												X			
	4. 8-5	Crystal Creek Pit		X			X					X	X	X							X			
	5. 8-6	Lamar River Quarry		X					X					X	X						X			

APPENDIX A (Modified from FHW

QUADRANGLE		NUMBER	NAME	ADMINISTRATION OR OWNERSHIP			
				NPS ADMIN.	FS. ADMIN.	STATE ADMIN.	PRIVATE PROP.
Tower Junction (Cont'd).	6.	8-7	Slough Creek Pit	X			
	7.	8-8	Elk Trap Pit	X			
	8.	1-G-1	Mount Washburn Quarr	X			
	9.	1-G-2	Pkng. A. Rd. Jct. Qu	X			
	10.	1-G-3	Long Curve Quarry	X			
	11.	1-G-4	Tower Falls Quarry	X			
	12.	1-G-5	Tower Falls Pit	X			
	13.	1-G-6	Mount Washburn Viewp	X			
	14.	1-H-1	Elk Creek Pit	X			
	15.	1-H-2	Yanceys Ranger Sta.	X			
	16.	1-H-3	Garnet Hill Pit	X			
	17.	P-H-1	Yancey Creek Site	X			
	18.	P-H-2	Elk Creek # 2	X			
	19.	P-H-3	Elk Creek # 3	X			
West Thumb	1.	4-1	MT Pwr. & Light Camp	X			
	2.	4-2	Grant Campground Sit	X			
	3.	4-3	West Thumb Pwr. Line	X			
	4.	4-4	Dogshead Creek Pit	X			
	5.	4-5	Dogshead Creek West	X			
	6.	4-6	Pit West of Old High	X			
	7.	4-7	Shoshone Lake Trail	X			
	8.	4-8	Riddle Lake Trail W.	X			
	9.	4-10	Dogshead Creek Marsh	X			
	10.	4-11	Lewis Lake North Sit	X			
	11.	4-12	Heart Lake Trail Pit	X			
	12.	4-13	Old Lewis L. Campgr.	X			
	13.	4-14	Lewis Lake Pit	X			
	14.	4-21	Grant Village E. Res	X			
	15.	4-22	Grant West Pit	X			
	16.	4-23	Lewis L. W. Campgr.	X			
	17.	1-D-2	Dry Fk. DeLacey Cr.	X			
	18.	1-D-3	Continental Divide P	X			
	19.	1-D-4	Little Thumb Cr. N.	X			
	20.	1-D-5	Little Thumb Cr. S.	X			
	21.	1-E-1	Arnica Creek Pit	X			
	22.	1-E-2	Little Thumb Creek P	X			
	23.	1-E-3	Pumice Point Pit	X			
West Yellowstone	1.	3-4	Old Fountain Trail P	X			
	2.	3-5	Madison R. Lookout P	X			
	3.	3-6	Madison R. Turnout P	X			
	4.	3-7	West Entrance Pit	X			
	5.	3-7A	West Entrance Old Pi	X			
	6.	WYE-1	Madison Plateau Rd P		X		
	7.	WYE-2	Madison Arm Road Pit		X		
	8.	WYE14	Airport Pit			X	

APPENDIX A (Modified from FHWA 1991b)

YELLOWSTONE NATIONAL PARK

QUADRANGLE	NUMBER	NAME	PRELIMINARY RECOMMENDATION				REASON(S) FOR PRELIMINARY RECOMMENDATION														ADMINISTRATION OR OWNERSHIP			
			USE	NO USE	POSSIBLE USE	MORE INVSTG.	SITE RCLAIMD	NEEDS RCLMATN	POOR QUAL.	SMALL QUANT.	SOURCE DEPLTED	POOR ACCESS	AGENCY DECISN	HIGHLY VISIBLE	SNSITVE AREA	GEOTHRM AREA	PUB USE AREA	ADMIN. AREA	NOT LOCATED	OTHER USE	NPS ADMIN.	FS. ADMIN.	STATE ADMIN.	PRIVATE PROP.
Tower Junction (Cont'd).	6. 8-7	Slough Creek Pit		X				X	X			X									X			
	7. 8-8	Elk Trap Pit		X								X			X						X			
	8. 1-G-1	Mount Washburn Quarry		X					X					X							X			
	9. 1-G-2	Pkng. A. Rd. Jct. Quarry		X					X				X								X			
	10. 1-G-3	Long Curve Quarry		X					X					X							X			
	11. 1-G-4	Tower Falls Quarry		X									X	X							X			
	12. 1-G-5	Tower Falls Pit		X				X	X									X			X			
	13. 1-G-6	Mount Washburn Viewpoint		X					X				X	X							X			
	14. 1-H-1	Elk Creek Pit		X			X													X	X			
	15. 1-H-2	Yanceys Ranger Sta. Site		X								X	X								X			
	16. 1-H-3	Garnet Hill Pit		X				X	X	X				X			X				X			
	17. P-H-1	Yancey Creek Site		X									X	X	X						X			
	18. P-H-2	Elk Creek # 2		X									X	X							X			
	19. P-H-3	Elk Creek # 3		X								X	X								X			
West Thumb	1. 4-1	MT Pwr. & Light Camp Pit		X			X				X							X		X	X			
	2. 4-2	Grant Campground Site		X											X		X				X			
	3. 4-3	West Thumb Pwr. Line Pit		X							X							X		X	X			
	4. 4-4	Dogahead Creek Pit		X						X		X									X			
	5. 4-5	Dogshead Creek West Pit		X						X		X									X			
	6. 4-6	Pit West of Old Highway		X					X	X		X									X			
	7. 4-7	Shoahone Lake Trail West		X								X	X								X			
	8. 4-8	Riddle Lake Trail W. Pit		X				X	X												X			
	9. 4-10	Dogshead Creek Marsh Pit		X						X											X			
	10. 4-11	Lewis Lake North Site		X								X	X								X			
	11. 4-12	Heart Lake Trail Pit		X				X		X										X	X			
	12. 4-13	Old Lewis L. Campgr. Pit		X				X	X												X			
	13. 4-14	Lewis Lake Pit		X				X	X												X			
	14. 4-21	Grant Village E. Res Pit		X			X				X							X			X			
	15. 4-22	Grant West Pit		X			X				X							X		X	X			
	16. 4-23	Lewis L. W. Campgr. Pit		X			X				X						X			X	X			
	17. 1-D-2	Dry Fk. DeLacey Cr. Pit		X									X	X	X						X			
	18. 1-D-3	Continental Divide Pit		X						X				X	X						X			
	19. 1-D-4	Little Thumb Cr. N. Pit		X						X		X									X			
	20. 1-D-5	Little Thumb Cr. S. Pit		X								X	X								X			
	21. 1-E-1	Arnica Creek Pit		X						X					X						X			
	22. 1-E-2	Little Thumb Creek Pit		X				X	X						X						X			
	23. 1-E-3	Pumice Point Pit		X				X										X		X	X			
West Yellowstone	1. 3-4	Old Fountain Trail Pit	X			X		X													X			
	2. 3-5	Madison R. Lookout Pit		X			X														X			
	3. 3-6	Madison R. Turnout Pit		X				X													X			
	4. 3-7	West Entrance Pit		X				X										X		X	X			
	5. 3-7A	West Entrance Old Pit		X				X	X									X		X	X			
	6. WYE-1	Madison Plateau Rd Pit			X	X		X														X		
	7. WYE-2	Madison Arm Road Pit		X				X	X													X		
	8. WYE14	Airport Pit		X				X	X														X	

APPENDIX A (Modified from FHWA 1

QUADRANGLE		NUMBER	NAME	NPS ADMIN.	FS. ADMIN.	STATE ADMIN.	PRIVATE PROP.
				ADMINISTRATION OR OWNERSHIP			
Abiathar Peak	1.	8-9A	Lamar Ranger Sta. R. Pit	X			
	2.	8-9B	Lamar Ranger Sta. Pit	X			
	3.	8-10	Lamar R. Picnic A. Pit	X			
	4.	8-11	Trout Lake Pit	X			
	5.	8-12	Soda Butte Cr. Tops. Pit	X			
	6.	8-13	Pebble Creek Pit	X			
	7.	8-14	Pebble Creek Quarry	X			
	8.	8-15	Soda Butte South Pit	X			
	9.	8-16	Soda Butte North Pit	X			
	10.	8-18	Soda Butte Cr. Dry Wash	X			
	11.	8-19	Icebox Canyon	X			
Beartooth Butte	1.	CC-9	Lily Lake Site		X		
	2.	CC-10	Ghost Cr. Pit(Muddy Cr).		X		
	3.	CC-11	Clarks Fork Trlhd. Site		X		
	4.	CC-12	Crandall Park Pit		X		
Canyon Village	1.	1-E-4	Bridge Bay Quarry	X			
	2.	1-E-5	Natural Bridge Pit	X			
	3.	1-E-6	Lake Incinerator Pit	X			
	4.	1-F1P	Fishing Bridge #1 Pit	X			
	5.	1-F2P	Fishing Bridge #2 Pit	X			
	6.	1-F3P	Trout Creek Pit	X			
	7.	1-F4P	Hayden Valley Pit	X			
	8.	1-G-7	Canyon U. Srvce. Rd. Pi	X			
	9.	1-G-8	Old Canyon Campgr. Pit	X			
	10.	5-1	Pelican Cr Campgr. Pit	X			
	11.	5-2	Squaw Lake Pit	X			
	12.	5-3	Sedge Creek Pit East	X			
	13.	5-4	Sedge Creek Pit West	X			
	14.	5-5	Old Butte Springs Pit	X			
	15.	5-6	Lake Butte Talus Pit	X			
	16.	5-7	Lake Butte South	X			
	17.	5-19	Fishing Bridge Pit	X			
Chimney R.	1.	5-20	Goff Creek Pit		X		
Clayton Mt.	1.	5-21	Mummy Cave Pit		X		
Cliff Lake	1.	WYE-6	Trout Creek Pit			X	
Cooke City	1.	CC-1	Cooke City Tailings Pon				X
	2.	CC-2	Cooke City Pit		X		
	3.	CC-3	Lulu Pass # 1		X		
	4.	CC-4	Lulu Pass # 2		X		
	5.	CC-5	State Line Talus N & S		X		
	6.	CC-14	Daisy Pass Road Area		X		
	7.	CC-15	New World Mines				X

1

POTENTIAL BORROW SITE WASTE SITE & STAGING AREA MATRIX

APPENDIX A (Modified from FHWA 1991b)

YELLOWSTONE NATIONAL PARK

QUADRANGLE	NUMBER	NAME	POTENTIAL USE						CONDITION OF SITE												ADMINISTRATION OR OWNERSHIP			
			NONE IDENT.	BORROW SITE	WASTE SITE	TOPSOIL SOURCE	STAGING AREA	MAINT AREA	SITE RCLAIMD	NEEDS RCLMATN	SOURCE DEPLTED	POOR ACCESS	REMOTE LOCATN	AGENCY DECISN	HIGHLY VISIBLE	SNSITVE AREA	GEOTHRM AREA	PUB USE AREA	ADMIN. AREA	OTHER USE	NPS ADMIN.	FS. ADMIN	STATE ADMIN.	PRIVATE PROP.
Abiathar Peak	1. 8-9A	Lamar Ranger Sta. R. Pit	X											X	X	X					X			
	2. 8-9B	Lamar Ranger Sta. Pit	X											X					X	X	X			
	3. 8-10	Lamar B. Picnic A. Pit	X						X					X	X	X		X			X			
	4. 8-11	Trout Lake Pit	X						X					X	X	X					X			
	5. 8-12	Soda Butte Cr. Tops. Pit	X						X					X	X	X					X			
	6. 8-13	Pebble Creek Pit	X						X					X							X			
	7. 8-14	Pebble Creek Quarry	X											X	X	X					X			
	8. 8-15	Soda Butte South Pit	X																		X			
	9. 8-16	Soda Butte North Pit	X											X							X			
	10. 8-18	Soda Butte Cr. Dry Wash		X						X					X						X			
	11. 8-19	Icebox Canyon	X											X	X	X					X			
Beartooth Butte	1. CC-9	Lily Lake Site		X																		X		
	2. CC-10	Ghost Cr. Pit(Muddy Cr).		X	X		X	X		X												X		
	3. CC-11	Clarks Fork Trlhd. Site	X										X		X			X		X		X		
	4. CC-12	Crandall Park Pit		X	X		X			X			X									X		
Canyon Village	1. 1-E-4	Bridge Bay Quarry		X	X	X	X	X		X						X					X			
	2. 1-E-5	Natural Bridge Pit			X		X	X		X	X					X			X	X	X			
	3. 1-E-6	Lake Incinerator Pit		X	X		X	X		X						X			X	X	X			
	4. 1-F1P	Fishing Bridge #1 Pit	X											X	X	X					X			
	5. 1-F2P	Fishing Bridge #2 Pit	X											X	X	X					X			
	6. 1-F3P	Trout Creek Pit	X						X			X		X		X					X			
	7. 1-F4P	Hayden Valley Pit	X											X	X	X					X			
	8. 1-G-7	Canyon U. Srvce. Rd. Pit			X				X										X	X	X			
	9. 1-G-8	Old Canyon Campgr. Pit			X		X	X		X	X								X	X	X			
	10. 5-1	Pelican Cr Campgr. Pit			X									X		X					X			
	11. 5-2	Squaw Lake Pit		X	X		X			X						X					X			
	12. 5-3	Sedge Creek Pit East	X											X	X	X					X			
	13. 5-4	Sedge Creek Pit West	X											X	X	X					X			
	14. 5-5	Old Butte Springs Pit								X											X			
	15. 5-6	Lake Butte Talus Pit		X	X		X			X									X		X			
	16. 5-7	Lake Butte South	X											X	X	X					X			
	17. 5-19	Fishing Bridge Pit	X						X										X		X			
Chimney R.	1. 5-20	Goff Creek Pit		X	X		X			X			X									X		
Clayton Mt.	1. 5-21	Mummy Cave Pit		X	X								X		X	X						X		
Cliff Lake	1. WYE-6	Trout Creek Pit	X					X		X			X							X			X	
Cooke City	1. CC-1	Cooke City Tailings Pond	X						X															X
	2. CC-2	Cooke City Pit		X	X					X												X		
	3. CC-3	Lulu Pass # 1		X	X	X	X															X		
	4. CC-4	Lulu Pass # 2		X	X	X																X		
	5. CC-5	State Line Talus N & S		X						X					X							X		
	6. CC-14	Daisy Pass Road Area	X									X			X							X		
	7. CC-15	New World Mines	X																	X				X

1

POTENTIAL BORROW SITE WASTE SITE & STAGING AREA MATRIX

APPENDIX A (Modified from FHWA

QUADRANGLE	NUMBER	NAME	ADMINISTRATION OR OWNERSHIP				
			R	NPS ADMIN.	FS. ADMIN.	STATE ADMIN.	PRIVATE PROP.
Cutoff Mountain	1. 8-20	Warm Springs Picnic A.		X			
	2. 8-17	Ranger Res. West Pit		X			
Deep Lake	1. CC-13	Dead Indian Creek Pit			X		
Eagle Peak	1. 5-9	Cub Creek Quarry		X			
	2. 5-10	Sylvan Lake North		X			
	3. 5-11	Sylvan Lake Pit		X			
	4. 5-12	Sylvan Pass Pit		X			
	5. 5-13	Sylvan Pass East Pit		X			
	6. 5-14	Middle Creek Quarry		X			
	7. 5-15	Line Change Quarry		X			
	8. 5-16	1961 Survey Pit		X			
	9. 5-17	Service Rd Junction Pit		X			
	10. 5-18	East Entrance Pit		X			
Fridley Pk.	1. GN-21	Point of Rocks Pit				X	
Gardiner	1. GN-6	Northern Pacific Pit		X			
	2. GN-7	Gardiner Cemetery Pit		X			
	3. GN-8	Laubach Pit					X
	4. GN-11	Gresswell Pit					X
	5. GN-15	Jardine Pit					X
	6. GN-16	Eagle Creek Pit			X		
	7. GN-17	Phelps Creek Quarry # 1					X
	8. GN-18	Phelps Creek Quarry # 2					X
	9. GN-19	Jardine Road Quarry					X
	10. GN-20	Gardiner Basalt Pit					X
	13. GN-24	Little Trail Cr. Site			X		
Hebgen Dam	1. WYE-3	Watkins Creek Pit			X		
Henrys Lake	1. WYE-4	Targhee Creek Pit				X	
	2. WYE-5	North Henrys Lake Pit				X	
Huckleberry Mountain	1. 4-15	Plateau Trail Pit		X			
	2. 4-16	Lewis R. Gooseneck Pit		X			
	3. 4-17	Old Lewis Canyon Rd Pit		X			
	4. 4-18	Crawfish Creek Pit		X			
	5. 4-19	Lewis-Snake River Pit		X			
	6. 4-20	Snake River Bar Pit		X			
	7. GT-1	Dime Creek Pit		X			
	8. GT-2	Snake River Pit #1		X			
	9. GT-3	Snake River Pit # 2		X			
	10. GT-4	Flagg Ranch Site #1		X			
	11. GT-5	Flagg Ranch Site #2		X			
	12. GT-6	Flagg Ranch Site #3		X			
	13. GT-7	Snake R. Ranger Sta Pit		X			

2

POTENTIAL BORROW SITE WASTE SITE & STAGING AREA MATRIX

APPENDIX A (Modified from FHWA 1991b)

YELLOWSTONE NATIONAL PARK

QUADRANGLE	NUMBER		NAME	POTENTIAL USE						CONDITION OF SITE												ADMINISTRATION OR OWNERSHIP			
				NONE IDENT.	BORROW SITE	WASTE SITE	TOPSOIL SOURCE	STAGING AREA	MAINT. AREA	SITE RCLAIMD	NEEDS RCLMATN	SOURCE DEPLTED	POOR ACCESS	REMOTE LOCATN	AGENCY DECISN	HIGHLY VISIBLE	SNSITVE AREA	GEOTHRM AREA	PUB USE AREA	ADMIN AREA	OTHER USE	NPS ADMIN	FS. ADMIN	STATE ADMIN	PRIVATE PROP.
Cutoff Mountain	1.	8-20	Warm Springs Picnic A.	X									X		X							X			
	2.	8-17	Ranger Res. West Pit	X									X		X		X					X			
Deep Lake	1.	CC-13	Dead Indian Creek Pit	X							X			X		X					X		X		
Eagle Peak	1.	5-9	Cub Creek Quarry		X	X		X	X		X									X		X			
	2.	5-10	Sylvan Lake North	X											X	X	X					X			
	3.	5-11	Sylvan Lake Pit		X	X		X			X						X					X			
	4.	5-12	Sylvan Pass Pit		X						X					X						X			
	5.	5-13	Sylvan Pass East Pit	X												X						X			
	6.	5-14	Middle Creek Quarry	X											X	X						X			
	7.	5-15	Line Change Quarry	X												X						X			
	8.	5-16	1961 Survey Pit	X												X						X			
	9.	5-17	Service Rd Junction Pit	X												X						X			
	10.	5-18	East Entrance Pit		X								X			X						X			
Fridley Pk.	1.	GN-21	Point of Rocks Pit	X							X	X		X		X								X	
Gardiner	1.	GN-6	Northern Pacific Pit	X												X						X			
	2.	GN-7	Gardiner Cemetery Pit		X	X		X	X		X					X				X		X			
	3.	GN-8	Laubach Pit	X							X	X													X
	4.	GN-11	Gresswell Pit	X						X															X
	5.	GN-15	Jardine Pit	X										X		X									X
	6.	GN-16	Eagle Creek Pit	X									X	X									X		
	7.	GN-17	Phelps Creek Quarry # 1	X							X					X					X				X
	8.	GN-18	Phelps Creek Quarry # 2	X							X					X					X				X
	9.	GN-19	Jardine Road Quarry	X							X					X									X
	10.	GN-20	Gardiner Basalt Pit	X												X									X
	13.	GN-24	Little Trail Cr. Site		X			X						X									X		
Hebgen Dam	1.	WYE-3	Watkins Creek Pit	X						X			X	X									X		
Henrys Lake	1.	WYE-4	Targhee Creek Pit	X							X			X		X								X	
	2.	WYE-5	North Henrys Lake Pit	X							X			X		X								X	
Huckleberry Mountain	1.	4-15	Plateau Trail Pit	X													X					X			
	2.	4-16	Lewis R. Gooseneck Pit	X							X											X			
	3.	4-17	Old Lewis Canyon Rd Pit		X	X							X	X								X			
	4.	4-18	Crawfish Creek Pit			X		X	X		X									X		X			
	5.	4-19	Lewis-Snake River Pit	X						X			X				X					X			
	6.	4-20	Snake River Bar Pit	X						X						X	X		X			X			
	7.	GT-1	Dime Creek Pit	X											X		X					X			
	8.	GT-2	Snake River Pit #1			X		X			X									X		X			
	9.	GT-3	Snake River Pit # 2		X	X	X	X			X									X		X			
	10.	GT-4	Flagg Ranch Site #1	X											X		X					X			
	11.	GT-5	Flagg Ranch Site #2	X											X		X			X		X			
	12.	GT-6	Flagg Ranch Site #3	X											X							X			
	13.	GT-7	Snake R. Ranger Sta Pit	X											X					X		X			

2

POTENTIAL BORROW SITE WASTE SITE & STAGING AREA MATRIX

APPENDIX A (Modified from FHWA K

QUADRANGLE		NUMBER	NAME		ADMINISTRATION OR OWNERSHIP			
				ER	NPS ADMIN.	FS. ADMIN.	STATE ADMIN.	PRIVATE PROP.
Madison Junction	1.	3-1	Mount Jackson Pit		X			
	2.	3-1A	Mt. Jackson Talus Quarr		X			
	3.	3-2&3	West Mt. Haynes Pits		X			
	4.	3-8	Madison Lagoon Pit		X			
	5.	1-B-4	Secret Valley Pit		X			
	6.	1-B-5	Mesa Road Bridge Pit		X			
	7.	1-B-6	Tuff Cliff Pit		X			
	8.	1-B-7	Terrace Spring Pit		X			
	9.	1-B-8	Madison Junction Pit		X			
	10.	1-C-2	Mesa Road Center Pit		X			
	11.	1-C2A	Mesa Burn Pit		X			
	12.	1-C2B	Mesa Maintenance Site		X			
	13.	1-C-3	Mesa Road West Pit		X			
	14.	1-C-4	Fairy Falls Ent Rd Pit		X			
	15.	1-C-5	Goose Lake Pit		X			
	16.	1-C-6	Hot Lake Pit		X			
	17.	1-C-7	Hot Lake Kame Pit		X			
	18.	1-C-8	Tangled Creek Pit		X			
	19.	1-C-9	S. Ent Firehole Loop P		X			
	20.	1-C10	Whiskey Flats Pit		X			
	21.	1-C11	(& 12) Rabbit Creek Pit		X			
	22.	1-C14	Firehole # 1 Pit		X			
	23.	1-C15	Nez Perce Quarry		X			
Mammoth	1.	1-A-1	Swan Lake Talus		X			
	2.	1-A-2	Swan Lake Pit East		X			
	3.	1-A-3	Swan Lake Flats Pit		X			
	4.	1-A-4	Swan Lake Pit West		X			
	5.	1-A-5	Apollinaris Spr. S. Pit		X			
	6.	1-A-6	Semi-Centenn. Geys. Pit		X			
	7.	1-A-7	Swan Lake Pit North		X			
	8.	1-A-8	Bunsen Peak West Pit		X			
	9.	1-A-9	Glen Creek Site		X			
	10.	1-A10	Upper Mammoth Res. Are		X			
	11.	1-A11	Upper Mammoth Terrace		X			
	12.	1-A12	Indian Creek Campgr. S		X			
	13.	1-H-4	Phantom Lake Pit		X			
	14.	1-H-5	Frog Rock East Extensi		X			
	15.	1-H-6	Frog Rock Pit		X			
	16.	1-H-7	Elk Rocks Pit		X			
	17.	1-H-8	Blacktail Patr. Cab. P		X			
	18.	1-H-9	Blacktail Deer Creek		X			
	19.	1-H10	Wraith Falls Site		X			
	20.	1-H11	Lava Creek Campgr. Pit		X			
	21.	1-H12	Lava Creek Canyon Talu		X			
	22.	1-H13	Capital Hill Pit		X			

3

POTENTIAL BORROW SITE WASTE SITE & STAGING AREA MATRIX

APPENDIX A (Modified from FHWA 1991b)

YELLOWSTONE NATIONAL PARK

QUADRANGLE	NUMBER	NAME	POTENTIAL USE						CONDITION OF SITE												ADMINISTRATION OR OWNERSHIP			
			NONE IDENT.	BORROW SITE	WASTE SITE	TOPSOIL SOURCE	STAGING AREA	MAINT. AREA	SITE RCLAIMD	NEEDS RCLMATN	SOURCE DEPLTED	POOR ACCESS	REMOTE LOCATN.	AGENCY DECISN	HIGHLY VISIBLE	SNSITVE AREA	GEOTHRM AREA	PUB USE AREA	ADMIN. AREA	OTHER USE	NPS ADMIN	FS. ADMIN.	STATE ADMIN	PRIVATE PROP.
Madison Junction	1. 3-1	Mount Jackson Pit		X	X		X			X				X							X			
	2. 3-1A	Mt. Jackson Talus Quarry	X							X				X	X						X			
	3. 3-2&3	West Mt. Haynes Pits		X	X		X	X		X									X		X			
	4. 3-8	Madison Lagoon Pit	X						X		X								X	X	X			
	5. 1-B-4	Secret Valley Pit		X	X		X			X											X			
	6. 1-H-5	Mesa Road Bridge Pit	X									X		X	X						X			
	7. 1-H-6	Tuff Cliff Pit	X											X							X			
	8. 1-H-7	Terrace Spring Pit	X											X		X	X				X			
	9. 1-H-8	Madison Junction Pit		X	X		X	X		X											X			
	10. 1-C-2	Mesa Road Center Pit		X	X		X	X		X									X	X	X			
	11. 1-C2A	Mesa Burn Pit			X			X		X									X	X	X			
	12. 1-C2B	Mesa Maintenance Site			X		X	X		X									X	X	X			
	13. 1-C-3	Mesa Road West Pit			X										X						X			
	14. 1-C-4	Fairy Falls Ent Rd Pit	X												X	X					X			
	15. 1-C-5	Goose Lake Pit	X												X						X			
	16. 1-C-6	Hot Lake Pit	X						X					X							X			
	17. 1-C-7	Hot Lake Kame Pit	X						X					X							X			
	18. 1-C-8	Tangled Creek Pit			X					X						X					X			
	19. 1-C-9	S. Ent Firehole Loop Pit	X							X						X					X			
	20. 1-C10	Whiskey Flats Pit		X	X					X						X					X			
	21. 1-C11	(& 12) Rabbit Creek Pits	X						X		X			X					X	X	X			
	22. 1-C14	Firehole # 1 Pit					X	X	X										X	X	X			
	23. 1-C15	Nez Perce Quarry		X						X						X	X				X			
Mammoth	1. 1-A-1	Swan Lake Talus	X											X	X						X			
	2. 1-A-2	Swan Lake Pit East			X		X	X		X									X	X	X			
	3. 1-A-3	Swan Lake Flats Pit			X					X									X		X			
	4. 1-A-4	Swan Lake Pit West		X	X					X									X		X			
	5. 1-A-5	Apollinaris Spr. S. Pit	X							X					X	X					X			
	6. 1-A-6	Semi-Centenn. Geys. Pit	X									X				X					X			
	7. 1-A-7	Swan Lake Pit North			X					X					X	X					X			
	8. 1-A-8	Bunsen Peak West Pit			X					X					X	X					X			
	9. 1-A-9	Glen Creek Site	X											X	X						X			
	10. 1-A10	Upper Mammoth Res. Area	X																X		X			
	11. 1-A11	Upper Mammoth Terrace A.	X											X	X	X					X			
	12. 1-A12	Indian Creek Campgr. S.	X											X				X			X			
	13. 1-H-4	Phantom Lake Pit	X											X							X			
	14. 1-H-5	Frog Rock East Extension	X											X							X			
	15. 1-H-6	Frog Rock Pit		X	X		X	X		X									X		X			
	16. 1-H-7	Elk Rocks Pit		X	X					X				X					X	X	X			
	17. 1-H-8	Blacktail Patr. Cab. Pit		X	X		X			X						X			X		X			
	18. 1-H-9	Blacktail Deer Creek	X											X	X						X			
	19. 1-H10	Wraith Falls Site	X											X	X	X					X			
	20. 1-H11	Lava Creek Campgr. Pit	X											X	X	X		X			X			
	21. 1-H12	Lava Creek Canyon Talus	X											X	X	X					X			
	22. 1-H13	Capital Hill Pit	X						X						X	X					X			

APPENDIX A (Modified from FHWA 1

QUADRANGLE		NUMBER	NAME	ADMINISTRATION OR OWNERSHIP			
				NPS ADMIN.	FS. ADMIN.	STATE ADMIN.	PRIVATE PROP.
Miner	1.	GN-1	Reese Creek Pit	X			
	2.	GN-2	Railroad Wye Pit	X			
	3.	GN-3	Stephens Cr. Nursery Pi	X			
	4.	GN-4	Ranger. Sta. Entr. Pit	X			
	5.	GN-5	Stephens Creek Pit	X			
	6.	GN-9	Pappesh Pit				X
	7.	GN-10	Hoppe Pit				X
	8.	GN-12	Brogan Pit # 1				X
	9.	GN-13	Brogan Pit # 2				X
	10.	GN-14	Tom Miner Basin Pit				X
	11.	GN-22	Carbella Bar Pits			X	
	12.	GN-23	Royal Teton Ranch Pit				X
Norris Junction	1.	16-1	Norris Debris Dump Site	X			
	2.	16-2	Norris Pit & Maint Site	X			
	3.	16-3	Ice Lake Quarry	X			
	4.	16-4	Virginia Meadows Site	X			
	5.	16-5	Crystal F. Srv. Rd. Pit	X			
	6.	1-B-1	Gibbon Meadows Pit	X			
	7.	1-B-2	Gibbon High Cut Pit	X			
	8.	1-B-3	Gibbon Power Line Pit	X			
Old Faithful	1.	1-C13	Old Faithful Pit	X			
	2.	1-D-1	Lone Star Geyser Pit	X			
Pelican Cn.	1.	5-8	Cub Creek Gravel Pit	X			
Pilot Peak	1.	CC-6	Index Creek Bridge Site		X		
	2.	CC-7	Fox Creek Bridge Site		X		
	3.	CC-8	Pilot Creek Pit		X		
Teepee Cr.	1.	WYE-7	Johnson Creek Pit				X
	2.	WYE-8	Grayling South Pit		X		
	3.	WYE-9	Catfish Lane Pit				X
	4.	WYE10	Grayling Private Pit				X
	5.	WYE11	Grayling North Pit		X		
	6.	WYE12	Old Cabin Pit				X
	7.	WYE13	Bozeman Sand & Grav. Pi				X
Tower Junction	1.	8-1	Tower Junction Pit	X			
	2.	8-2	Junction Butte Pit	X			
	3.	8-3&4	Little America Pit	X			
	4.	8-5	Crystal Creek Pit	X			
	5.	8-6	Lamar River Quarry	X			

4

POTENTIAL BORROW SITE WASTE SITE & STAGING AREA MATRIX

APPENDIX A (Modified from FHWA 1991b)

YELLOWSTONE NATIONAL PARK

QUADRANGLE		NUMBER	NAME	POTENTIAL USE						CONDITION OF SITE												ADMINISTRATION OR OWNERSHIP			
				NONE IDENT	BORROW SITE	WASTE SITE	TOPSOIL SOURCE	STAGING AREA	MAINT. AREA	SITE RCLAIMD	NEEDS RCLMATN	SOURCE DEPLTED	POOR ACCESS	REMOTE LOCATN	AGENCY DECISN	HIGHLY VISIBLE	SNSITVE AREA	GEOTHRM AREA	PUB USE AREA	ADMIN. AREA	OTHER USE	NPS ADMIN.	FS. ADMIN.	STATE ADMIN.	PRIVATE PROP.
Miner	1.	GN-1	Reese Creek Pit		X	X				X												X			
	2.	GN-2	Railroad Wye Pit	X												X						X			
	3.	GN-3	Stephens Cr. Nursery Pit	X																X		X			
	4.	GN-4	Ranger. Sta. Entr. Pit	X												X						X			
	5.	GN-5	Stephens Creek Pit	X												X						X			
	6.	GN-9	Pappesh Pit	X							X					X									X
	7.	GN-10	Hoppe Pit	X						X		X				X					X				X
	8.	GN-12	Brogan Pit # 1	X							X			X		X									X
	9.	GN-13	Brogan Pit # 2	X							X	X		X		X									X
	10.	GN-14	Tom Miner Basin Pit	X							X			X		X									X
	11.	GN-22	Carbella Bar Pits	X							X			X					X		X			X	
	12.	GN-23	Royal Teton Ranch Pit		X	X					X														X
Norris Junction	1.	16-1	Norris Debris Dump Site			X					X	X								X	X	X			
	2.	16-2	Norris Pit & Maint Site		X	X		X	X		X									X	X	X			
	3.	16-3	Ice Lake Quarry		X	X		X			X						X			X		X			
	4.	16-4	Virginia Meadows Site	X												X	X					X			
	5.	16-5	Crystal F. Srv. Rd. Pit			X		X			X	X								X	X	X			
	6.	1-B-1	Gibbon Meadows Pit			X		X			X											X			
	7.	1-B-2	Gibbon High Cut Pit		X											X						X			
	8.	1-B-3	Gibbon Power Line Pit		X	X		X													X	X			
Old Faithful	1.	1-C13	Old Faithful Pit			X		X	X	X		X								X	X	X			
	2.	1-D-1	Lone Star Geyser Pit	X							X		X	X								X			
Pelican Cn.	1.	5-8	Cub Creek Gravel Pit		X	X		X			X											X			
Pilot Peak	1.	CC-6	Index Creek Bridge Site	X										X		X							X		
	2.	CC-7	Fox Creek Bridge Site	X												X							X		
	3.	CC-8	Pilot Creek Pit		X	X		X			X			X									X		
Teepee Cr.	1.	WYE-7	Johnson Creek Pit		X	X					X			X		X									X
	2.	WYE-8	Grayling South Pit	X							X				X	X	X						X		
	3.	WYE-9	Catfish Lane Pit		X	X					X			X											X
	4.	WYE10	Grayling Private Pit		X	X					X			X		X									X
	5.	WYE11	Grayling North Pit	X							X				X								X		
	6.	WYE12	Old Cabin Pit		X	X					X			X		X									X
	7.	WYE13	Bozeman Sand & Grav. Pit		X						X			X		X									X
Tower Junction	1.	8-1	Tower Junction Pit			X					X					X			X			X			
	2.	8-2	Junction Butte Pit	X									X									X			
	3.	8-3&4	Little America Pit		X	X					X											X			
	4.	8-5	Crystal Creek Pit	X						X			X		X	X						X			
	5.	8-6	Lamar River Quarry	X												X	X					X			

4

POTENTIAL BORROW SITE WASTE SITE & STAGING AREA MATRIX

APPENDIX A (Modified from FHWA 1

QUADRANGLE	NUMBER	NAME	ADMINISTRATION OR OWNERSHIP NPS ADMIN.	FS. ADMIN.	STATE ADMIN.	PRIVATE PROP.
Tower Junction (Cont'd).	6. 8-7	Slough Creek Pit	X			
	7. 8-8	Elk Trap Pit	X			
	8. 1-G-1	Mount Washburn Quarry	X			
	9. 1-G-2	Pkng. A. Rd. Jct. Quarry	X			
	10. 1-G-3	Long Curve Quarry	X			
	11. 1-G-4	Tower Falls Quarry	X			
	12. 1-G-5	Tower Falls Pit	X			
	13. 1-G-6	Mount Washburn Viewpoint	X			
	14. 1-H-1	Elk Creek Pit	X			
	15. 1-H-2	Yanceys Ranger Sta. Site	X			
	16. 1-H-3	Garnet Hill Pit	X			
	17. P-H-1	Yancey Creek Site	X			
	18. P-H-2	Elk Creek # 2	X			
	19. P-H-3	Elk Creek # 3	X			
West Thumb	1. 4-1	MT Pwr. & Light Camp Pit	X			
	2. 4-2	Grant Campground Site	X			
	3. 4-3	West Thumb Pwr. Line Pit	X			
	4. 4-4	Dogshead Creek Pit	X			
	5. 4-5	Dogshead Creek West Pit	X			
	6. 4-6	Pit West of Old Highway	X			
	7. 4-7	Shoshone Lake Trail West	X			
	8. 4-8	Riddle Lake Trail W. Pit	X			
	9. 4-10	Dogshead Creek Marsh Pit	X			
	10. 4-11	Lewis Lake North Site	X			
	11. 4-12	Heart Lake Trail Pit	X			
	12. 4-13	Old Lewis L. Campgr. Pit	X			
	13. 4-14	Lewis Lake Pit	X			
	14. 4-21	Grant Village E. Res Pit	X			
	15. 4-22	Grant West Pit	X			
	16. 4-23	Lewis L. W. Campgr. Pit	X			
	17. 1-D-2	Dry Fk. DeLacey Cr. Pit	X			
	18. 1-D-3	Continental Divide Pit	X			
	19. 1-D-4	Little Thumb Cr. N. Pit	X			
	20. 1-D-5	Little Thumb Cr. S. Pit	X			
	21. 1-E-1	Arnica Creek Pit	X			
	22. 1-E-2	Little Thumb Creek Pit	X			
	23. 1-E-3	Pumice Point Pit	X			
West Yellowstone	1. 3-4	Old Fountain Trail Pit	X			
	2. 3-5	Madison R. Lookout Pit	X			
	3. 3-6	Madison R. Turnout Pit	X			
	4. 3-7	West Entrance Pit	X			
	5. 3-7A	West Entrance Old Pit	X			
	6. WYE-1	Madison Plateau Rd Pit		X		
	7. WYE-2	Madison Arm Road Pit		X		
	8. WYE14	Airport Pit			X	

5

POTENTIAL BORROW SITE WASTE SITE & STAGING AREA MATRIX

APPENDIX A (Modified from FHWA 1991b)

YELLOWSTONE NATIONAL PARK

QUADRANGLE	NUMBER	NAME	POTENTIAL USE						CONDITION OF SITE												ADMINISTRATION OR OWNERSHIP			
			NONE IDENT.	BORROW SITE	WASTE SITE	TOPSOIL SOURCE	STAGING AREA	MAINT. AREA	SITE RCLAIMD	NEEDS RCLMATN	SOURCE DEPLTED	POOR ACCESS	REMOTE LOCATN	AGENCY DECISN	HIGHLY VISIBLE	SNSITVE AREA	GEOTHRM AREA	PUB USE AREA	ADMIN AREA	OTHER USE	NPS ADMIN.	FS ADMIN.	STATE ADMIN	PRIVATE PROP.
Tower Junction (Cont'd).	6. 8-7	Slough Creek Pit			X					X		X									X			
	7. 8-8	Elk Trap Pit	X									X				X					X			
	8. 1-G-1	Mount Washburn Quarry		X											X						X			
	9. 1-G-2	Pkng. A. Rd. Jct. Quarry	X											X							X			
	10. 1-G-3	Long Curve Quarry		X											X						X			
	11. 1-G-4	Tower Falls Quarry	X											X	X						X			
	12. 1-G-5	Tower Falls Pit		X	X					X									X		X			
	13. 1-G-6	Mount Washburn Viewpoint	X											X	X						X			
	14. 1-H-1	Elk Creek Pit	X						X											X	X			
	15. 1-H-2	Yanceys Ranger Sta. Site	X									X	X	X							X			
	16. 1-H-3	Garnet Hill Pit		X	X					X					X			X			X			
	17. P-H-1	Yancey Creek Site	X											X	X	X					X			
	18. P-H-2	Elk Creek # 2	X											X	X						X			
	19. P-H-3	Elk Creek # 3	X									X		X							X			
West Thumb	1. 4-1	MT Pwr. & Light Camp Pit					X	X	X		X								X	X	X			
	2. 4-2	Grant Campground Site	X													X		X			X			
	3. 4-3	West Thumb Pwr. Line Pit	X					X			X								X	X	X			
	4. 4-4	Dogshead Creek Pit	X									X	X								X			
	5. 4-5	Dogshead Creek West Pit	X									X	X								X			
	6. 4-6	Pit West of Old Highway	X									X	X								X			
	7. 4-7	Shoshone Lake Trail West	X									X		X							X			
	8. 4-8	Riddle Lake Trail W. Pit		X	X					X											X			
	9. 4-10	Dogshead Creek Marsh Pit	X																		X			
	10. 4-11	Lewis Lake North Site	X									X		X							X			
	11. 4-12	Heart Lake Trail Pit			X					X										X	X			
	12. 4-13	Old Lewis L. Campgr. Pit		X	X					X											X			
	13. 4-14	Lewis Lake Pit			X					X											X			
	14. 4-21	Grant Village E. Res Pit	X						X		X								X		X			
	15. 4-22	Grant West Pit			X		X	X	X										X	X	X			
	16. 4-23	Lewis L. W. Campgr. Pit					X	X	X		X							X		X	X			
	17. 1-D-2	Dry Fk. DeLacey Cr. Pit	X											X	X	X					X			
	18. 1-D-3	Continental Divide Pit	X												X	X					X			
	19. 1-D-4	Little Thumb Cr. N. Pit	X									X	X								X			
	20. 1-D-5	Little Thumb Cr. S. Pit	X									X		X							X			
	21. 1-E-1	Arnica Creek Pit	X													X					X			
	22. 1-E-2	Little Thumb Creek Pit		X	X		X			X						X					X			
	23. 1-E-3	Pumice Point Pit		X	X					X									X	X	X			
West Yellowstone	1. 3-4	Old Fountain Trail Pit		X	X					X											X			
	2. 3-5	Madison R. Lookout Pit	X						X												X			
	3. 3-6	Madison R. Turnout Pit		X	X					X											X			
	4. 3-7	West Entrance Pit		X	X		X	X		X									X	X	X			
	5. 3-7A	West Entrance Old Pit		X	X		X			X									X	X	X			
	6. WYE-1	Madison Plateau Rd Pit	X							X			X									X		
	7. WYE-2	Madison Arm Road Pit		X	X		X	X		X												X		
	8. WYE14	Airport Pit		X	X		X			X													X	

5

POTENTIAL BORROW SITE WASTE SITE & STAGING AREA MATRIX

APPENDIX B

AUG 1991
RECEIVED
MMB Denver

AUG 1 1991

L3023 (660)

Memorandum

To: Acting Director

From: Associate Director, Operations (sgd) Willis P. Kriz

Subject: Special Directive on the Administrative Use of In-Park Borrow Material

Attached for your signature is a special directive which provides field direction on interpreting and applying the 1988 NPS Management Policies related to NPS use of borrow pits and spoil areas (Chapter 9, Page 4). The desire to ensure consistency among parks and avoid potential litigation is the impetus for developing specific field guidance on the administrative use of mineral materials in parks.

This guidance was prepared by a work group consisting of individuals from the Mining and Minerals Branch of the Land Resources Division, Water Resources Division, Denver Service Center, and selected regional offices and parks. A draft of this guidance was reviewed by the regional offices and parks.

If you have any questions regarding this directive, please contact Einar Olsen of the Mining and Minerals Branch at 343-4968.

Attachment

bcc: 100; 190; 500; 600
DEN-Shaver:Grasser:Higgins:Reading and Project Files
WASO-Kriz:McCoy:Olsen:Reading File
WASO:EOlsen:eo:7/30/91:transmit.mem:343-4968

March 3, 1849

United States Department of the Interior

TAKE PRIDE IN AMERICA

NATIONAL PARK SERVICE
P.O. BOX 37127
WASHINGTON, D.C. 20013-7127

IN REPLY REFER TO:
A5623(660)

August 5, 1991

SPECIAL DIRECTIVE 91-6

To: Directorate, Field Directorate, WASO Division Chiefs and Park Superintendents

From: ACTING Director Herbert S Cables

Subject: Field Guidance on Implementing the NPS Management Policies Re: Administrative Use of In-Park Borrow Material

This field guidance provides direction on interpreting and applying the 1988 NPS Management Policies related to NPS use of borrow pits and spoil areas (Chapter 9, Page 4). These policies contain several terms that are open to interpretation which could result in inconsistent implementation. The desire to ensure consistency among parks and avoid potential litigation is the impetus for developing specific field guidance on the administrative use of mineral materials in parks. This guidance is not applicable to coastal management issues such as navigation channel dredging, beach nourishment, dune rebuilding and natural levee repair. See NPS Management Policies Chapter 4, page 20, for guidance on shoreline management issues.

Definitions. For the purposes of this field guidance, the following terms are used:

Borrow pit - excavation from which mineral materials are taken.

Extraction or excavation site - a borrow pit or a quarry.

Functions necessary for park administration - actions defined in approved park plans or environmental compliance documents.

Mineral materials - common varieties of sand, stone, gravel, pumice, pumicite, cinders, clay, and common fill.

Spoil - native materials, e.g., soil, rock or overburden

Spoil area - disposal location for overburden or other soil or rock.

Quarry - an open pit or excavation where stone, sand, gravel or other mineral materials are obtained from open faces.

Use of In-Park Sources. In accordance with the NPS Management Policies, park managers should first look outside of parks for sand, gravel and borrow materials. In developing cost estimates for future park projects, park managers should assume that materials will be obtained from sources outside the park. In-park sources should only be considered if the following two tests are met: (1) acceptable sources exist in the park, and (2) economic factors make it totally impractical to import materials.

In determining whether "acceptable sources" exist in the park, park managers must evaluate the natural, cultural, socioeconomic, and visitor use effects of using existing and/or new sites. This guidance sets forth a series of questions that should be addressed in a written analysis evaluating the use of existing and new in-park sites. In the written analysis of new sites, park managers must address the requirements of NPS-12 (NEPA Compliance Guideline), other compliance/permit requirements, and all issues outlined below for existing pit use, including site selection criteria, reclamation plans, and economic considerations.

Potential NPS use of materials from new or existing sites on private lands inside park boundaries should be evaluated using the same process outlined for extraction from federally owned land in parks. This will require specific examination of park planning documents. For areas managed cooperatively as ecosystems, e.g., the Greater Yellowstone Area, resources outside of parks but in the ecosystem should be evaluated using the same criteria as in-park resources, subject to applicable laws.

The definition of "totally impractical" is, by necessity, case-specific. There is no set formula for determining what percentage increase in a project cost makes an outside source totally impractical. The park manager must weigh the expected costs and effects of an in-park source against expected costs and effects of outside sources to determine the acceptability of in-park sources.

Economic considerations to be evaluated for both outside and in-park sources include:

(1) cost of preparing appropriate planning documents, e.g., mineral source plan, NEPA compliance, technical studies including engineering, hydrologic, or reclamation analyses;
(2) cost of extraction of materials, and associated transportation, including equipment and labor cost;
(3) cost of damage to park roads resulting from truck traffic;
(4) cost of reclamation;
(5) traffic disruptions;
(6) health and safety implications of hauling material;
(7) cost associated with obtaining all State and local permits;
(8) potential savings of using old extraction sites for administrative purposes;

(9) benefits associated with having previously disturbed sites reclaimed;
(10) purchase price of mineral materials (if outside source); and
(11) cost of exotic plant management at project site(s) using outside sources, e.g., eradication or long term control, or costs of guaranteeing exotic species-free materials.

Monetary costs may often be greater when using sources outside of the park. However, when comparing the costs of inside sources versus outside sources, park managers should determine whether other funding sources exist which could cover the additional monetary cost of using outside sources, e.g., Federal Highway Administration, and factor that information into the analysis. Also, park managers should evaluate the possibility of extending the project over multiple years to make the use of outside sources economically feasible.

NPS Contractor Use of Borrow Pits and Spoil Areas. For purposes of this field guidance, mineral materials to be used by NPS contractors is the functional equivalent of NPS use. Contractors, including the Federal Highway Administration, performing work for the NPS on park projects may use mineral materials sources in the unit when such use is authorized by the Superintendent. However, the contractor's use of mineral materials, just as direct NPS use, must conform to NPS Management Policies, NEPA, other applicable statutes and regulations, and the criteria outlined herein.

Acceptable Sources Identified in Park Plan. Park management should ensure that acceptable sources for mineral materials are identified and analyzed in appropriate park planning documents and that the effects on natural and cultural resources have been considered and evaluated. Examples of plans in which such sources may be appropriately identified include general management plans, resource management plans, development concepts plans, and mineral materials source studies. If the park has plans for extensive mineral materials extraction, preparation of an areawide mineral materials source study may be appropriate. Planning documents addressing mineral materials sources must include appropriate NEPA and cultural resource compliance and public involvement. Parks should identify sites for extraction and disposal of mineral materials in advance, in anticipation of emergency situations, e.g., road slides, landslides, or floods, in the appropriate planning document. Additionally, managers should be aware that there can be cumulative effects from opening or continuing to use a number of mineral materials sites inside the park. Cumulative effects should be identified and analyzed in appropriate planning and/or environmental compliance documents.

Written Analysis. Any actual or potential in-park use of mineral materials from either new or existing sources requires a written analysis. This analysis shall include: basic site information such as name of pit, map, access, size, location in the park, relationship to other facilities, and management zoning. Answers to the enclosed questions, along with a determination of acceptability signed by the Superintendent comprise the administrative record for the use of an existing site. The written analysis should be used in determining what constitutes appropriate NEPA compliance, e.g., categorical exclusions, environmental assessments, or EISs. Analyses of new sites must address, in addition to the requirements of NPS-12, all issues outlined herein for existing pit use.

Use of In-Stream Sites. Generally, in-stream sources should not be considered. Stream channels and floodplains are generally recognized as sensitive resources and are not usually suitable as sources for sand, gravel, or borrow. However, under some conditions, use of these areas my result in fewer or shorter-term impacts than alternative upland sources. These sources of borrow may be considered for use when it can be demonstrated through appropriate scientific study that all of the following are met:

(1) upstream and downstream channel stability will not be affected;
(2) water quality and aquatic and terrestrial habitats will not be adversely impacted;
(3) extraction pits can be designed to resemble natural features and function in a manner that does not encourage morphologic or vegetative changes;
(4) the extraction site will refill with mineral materials similar in characteristics to the removed borrow; and
(5) replenishment will occur in a reasonable timeframe.

Additionally, when an in-stream source is used, post-extraction monitoring must be conducted to assess the degree to which the above criteria are achieved. No new sources will be established on designated wild or scenic rivers.

Use of Pits In Designated or Proposed Wilderness Areas. Borrow pits are not permitted in designated or proposed wilderness areas, with the exception of small quantity use of borrow for trails, which must be in accordance with an approved wilderness management plan.

Effects on Natural and Cultural Resources. In some cases, active and inactive mining sites may not have had adequate environmental analyses performed at the time of initial disturbance. Consequently, additional environmental analyses should be completed prior to the continued use or reactivation of an existing site. Resource evaluations should include: water, soils, vegetation, fish and wildlife, archeological and historic sites and landscapes. Determination of impacts, including an assessment of their significance and cumulative effects, must be made in accordance with appropriate NPS guidelines. The potential for exotic plants to be introduced, and to spread and persist, should be evaluated along with requirements for subsequent control.

Effects on Socioeconomic Resources. In evaluating alternative sources of borrow and selecting an actual source, park managers must consider the socioeconomic effects. These include effects on:

(1) existing local and regional land use patterns and zoning;
(2) direct and indirect effects on local and regional businesses and residents;
(3) the local and regional economy;
(4) other agencies (Federal, State, and local) and their projects; and
(5) concessions.

The socioeconomic analysis should also address impacts on park operations, e.g., need for additional park staffing, changes in staff schedules, traffic circulation, safety, and security.

Effects on Visitor Experience. The NPS strives to minimize the public's awareness of extraction activities, including the sights, sounds and smells associated with those activities. Extraction sites should not be located in areas of primary visitor use and should not be visible from areas of concentrated visitor use, nor from primary viewsheds. Continued use of existing sites should be evaluated for impacts on visitors and the visitors' experience. Factors to be considered include:

(1) type and degree of impacts;
(2) visibility of sites;
(3) expectation of visitors (wilderness vs. development zones);
(4) park zoning considerations; and,
(5) surrounding or adjacent views.

Reclamation. All mineral material sites in park units ultimately should be reclaimed. Park managers should ensure that an adequate reclamation plan is developed before authorizing use of in-park sources of mineral materials or continuing use of existing pits. Post-extraction use of the sites should be defined at the time site disturbance is being considered. This may include returning the area to pre-extraction use, reclaiming the site to be in harmony with surrounding areas, or using the site for administrative purposes, e.g., storage or staging areas. Areas to be used for administrative purposes should be recontoured and reclaimed to the maximum extent possible while still allowing for administrative use. Park managers must consider the cumulative effects of multiple administrative sites in determining appropriate post-extraction uses.

Reclamation plans must address:

(1) health and safety problems on site;
(2) control of active sedimentation/erosion problems;

(3) drainage issues;
(4) need to recontour (lay back) to allow revegetation;
(5) timeframe for achieving reclamation;
(6) reestablishment of native vegetation;
(7) sources of native plant material;
(8) control of exotics;
(9) topsoil storage and handling;
(10) access;
(11) contaminated or hazardous soils; and
(12) site monitoring.

Some aspects of reclamation can be most effectively accomplished concurrently with the extraction operation. Control of erosion and exotic species may need to be an ongoing effort. For long-term operations, portions of the disturbed area should be reclaimed as the operations proceed into other areas. All extraction sites developed or reopened for specific projects should be reclaimed within the timeframe of that project.

Park managers are encouraged to provide technical assistance to adjacent land owners in the preparation of reclamation plans where external source development, use, and reclamation could have potential adverse impacts on park resources.

Questions (See page 113 of this appendix for NPS reply).

In order to implement this guidance, a written analysis addressing the following questions should be prepared. These questions apply to both new and existing borrow pits and spoil areas. A written analysis must be prepared in conformance with the provisions of the NPS Management Policies.

1. What is the proposed project?

2. What type and amount of mineral material is necessary to complete the project?

Evaluating External Sources

3. Are the necessary mineral materials available from sources outside the park?

4. What is the cost to complete this project using mineral materials from outside sources and what are the general environmental impacts?

5. Do economic factors make it "totally impractical" to import materials?

6. What are the pertinent socioeconomic factors at the site and in the affected area?

Evaluating Internal Sources

7. Do previously disturbed sites exist inside the park that provide the quality and quantity of mineral materials needed? [Impact analysis and other environmental compliance documents will be more extensive if the site is new.]

8. Will the extraction operation remain in the existing disturbed area or will it expand onto previously undisturbed lands?

9. How is the site identified and zoned in appropriate park planning and/or environmental compliance documents?

10. What are the characteristics of the proposed extraction operation?

11. What are the natural resources at the site and in the affected area?

    a. Vegetation, including exotic plants
    b. Wildlife
    c. Soils
    d. Water resources
    e. Soils and Geology
    f. Air Quality
    g. Paleontological resources
    h. Other

12. What are the cultural resources at the site and in the affected area?

13. What are the impacts to park visitors, and what can be done to mitigate these impacts?

14. What are the impacts to natural and cultural resources, and what can be done to mitigate these impacts?

15. What are the impacts to the socioeconomic resources of the area, and what can be done to mitigate these impacts?

16. Describe how the proposed action could contribute to cumulative impacts over a period of time.

17. Would the action, when added to other past, present, and reasonably foreseeable future actions, have a significant effect?

18. Describe appropriate post extraction use and its consistency with planning documents.

19. Can the site be effectively reclaimed to accomplish the desired post extraction use?

20. What are the steps necessary to reclaim this site? Has a reclamation plan been prepared for this site?

21. Have compliance requirements been met?

a. NEPA
b. NHPA, Sections 106 and 110
c. Threatened and Endangered Species
d. Floodplains and Wetlands, 404 Permits
e. State and Local Permits (depending on jurisdiction)
f. Air Quality Permits
g. Others

22. What is the cost of the in-park source including the mitigation and reclamation measures identified above?

Park Manager Certification

Based on the answers to the above questions, and on analysis of the issues related to the extraction of mineral materials in this project # ______________, borrow site ____________ (# or name) has been determined as an acceptable site/source. Outside park sources have been evaluated and determined to be totally impractical from a budgetary standpoint. Effects to natural and cultural resources are not significant. Socioeconomic impacts and the effects on visitor use have been analyzed and are deemed to be acceptable. A reclamation plan for the site has been prepared. This action is consistent with all applicable compliance, permitting, and laws.

____

Superintendent's Signature and Date

ANSWERS TO QUESTIONS

(see page 6 of Appendix B)

1. See page 7 and page 34 of the document.
2. See page 51 of the document.
3. Yes
4. See page 51 and page 59 of the document.
5. This will be determined for route-specific road projects.
6. See "Affected Environment" section of the document.
7. Yes, see page 10 of the document.
8. This will be determined in route-specific environmental documents.
9. Sites are identified in Appendix A of this document and in FHWA, 1990, referenced in the document.
10. See page 41 of the document
11. See "Affected Environment" section of the document.
12. Same as #11
13. See "Environmental Consequences" section of the document.
14. Same as #13
15. Same as #13
16. See page 56 and page 61 of the document.
17. Same as #16
18. See page 10 and page 13 of the document.
19. This site-specific information will be determined in route-specific environmental documents.
20. Same as #19
21. See "Future Compliance Requirements" section of the document.
22. This will be determined in route-specific environmental documents.

APPENDIX C

VEGETATION MANAGEMENT FOR CONSTRUCTION IN YELLOWSTONE NATIONAL PARK

Revegetation efforts within the park have focused on careful management of topsoil as the only available growing medium and seed source. This is based on a park policy that seed obtained from sources outside the park would contaminate the park gene pools. Although it is a conservative method, the topsoil management approach has worked well.

The park has contracted with the Bridger Plant Material Center to assist in the formation of a park seed bank. In the future seed would be available for revegetation work. The park has also tested mulches and can make this information available upon request.

All construction work within the park involving ground disturbance should follow the criteria for revegetation accepted by the park. This includes:

1. All construction would be limited to that area necessary to complete required work. No activity, including vehicle or material use or storage, would be allowed outside the predetermined zone. If vehicles would be traveling through an area numerous times, the same tracks should be used to prevent compaction in other areas. Compacted zones must be treated (raking, aerating, and replacement of topsoil) to assist revegetation.

2. Excavation and improvement would be handled in manageable sections that reflect changes in the soil and vegetation. Trenching routes and disturbance zones would be flagged and approved by the park. All flagging and debris would be removed from the area after work is completed.

3. Sections would be rehabilitated as soon as possible. Topsoil may not be stockpiled over the winter or for longer than three months in sage brush/rabbit brush zones nor longer than six months in grass-dominated zones. Any deviation will be approved by the park.

4. Topsoil refers to the uppermost soil horizon. It is usually found in the top 2-6 inches. Topsoil would be removed and replaced from the same area. Care would be taken to ensure that topsoil and fill material are not mixed and are stockpiled in separate areas (i.e. topsoil to the right of the trench and fill to the left).

5. Vegetation over three feet in height must be removed prior to the removal of topsoil. Such vegetation shall be removed in a manner that least disturbs the topsoil. Topsoil may not be driven on, gouged, or compacted as vegetation is removed. Topsoil shall be removed before stumps are pushed. Any deviation from this process will be approved by the park.

6. After large trees are removed, topsoil would be removed from an area in a single cut including any vegetation that is three feet tall and under. Grubbing is not permitted.

7. Irregular land surfaces are recommended for a natural effect. Some rock outcropping and boulders could be left in place to create natural pockets for revegetation (see number 11). Deadfall snags could be stockpiled for later use on slopes that are very steep to provide catch points for soil.

8. Topsoil may not be used as bedding material. Separate bedding material will be obtained from sources approved by the park.

9. Topsoil would be replaced on site in a mixture of topsoil and vegetation associated with the topsoil, and would be reworked over the site in a manner that preserves the seed source while spreading the soil over the area.

10. No topsoil would be imported from outside the park or moved internally within the park unless approved by the park. Any imported fill will be checked for exotic plants.

11. Trees and shrubs are to be avoided if possible during trenching or excavation. Any trees removed during construction should be removed from the site unless specified by the park.

12. If replacement seed is required for revegetation in an area, the park would provide seed at cost to the contractor. Advance notice of six months to one year is required on projects exceeding 1,000 square feet.

13. Boulders unearthed during construction would be reburied or left exposed (with lower third buried) depending upon the location and extent of rock naturally occurring in the area.

14. The surface of the trench would be left mounded to allow for settling along the line.

15. If mulch is required in sensitive areas due to visibility or exotic plant infestation, the park would specify the type and depth of mulch to be used. Nitrogen will be added in small quantities to any wood product used on slopes to balance nitrogen lost through decomposition.

16. No fertilizer would be used in any revegetation work unless requested by the park.

17. If relocated due to road reconstruction, junction boxes or cans would be placed in the field and approved by the park. Location should be well screened by vegetation, topography, or large boulders.

18. All access to the site and stockpiling or staging areas must be identified by the contractor and approved by the park. These areas shall be revegetated using approved techniques upon the completion of the project.

19. All debris shall be removed from the site to an approved pit or hauled away as approved by the park.

20. Final review and inspection shall be made by the park before the work is accepted.

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